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A

BRIEF COMPEND

OF

AMERICAN

AGRICULTURE.

BY R. L. ALLEN.

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PREFACE.

The following brief compend of American Agriculture is intended as one of the first in the series of lessons for the American Farmer. The size precludes its embracing any thing beyond the shortest summary of the principles and practice by which he should be guided, in the honorable career he has selected. As a primary work, it is not desirable it should comprise so much as to alarm the tyro in agriculture with the magnitude of his subject. A concise and popular exposition of the principal topics to which his attention will necessarily be directed, will, it is believed, in connexion with his own observation and practice, give him a taste for further research, which will lead him to the fullest attainment in agricultural knowledge, which could be expected from his capacity and opportunities.

Much of what is detailed in the present volume, has been tested by the writer's own experience and observation. For the remainder, he is indebted to various oral and written information, derived from the best agriculturists, and especially from the valuable foreign and domestic agricultural periodicals of the present day.

Whenever *original* authority could be known or recollected, it has been credited; but many even of the most recent discoveries, have already passed through such numerous hands, and received so many shades of alteration or improvement, that their authors would hardly recognise their own offspring. It would not be strange therefore, if they had become incorporated in the mass of agricultural principles,

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without any indication of their origin. The same or similar discoveries and improvements, are also, not unfrequently made, without any interchange, by different minds, at remote distances. If any omissions of proper acknowledgment have occurred, the writer will be happy to correct them hereafter.

To the experienced and scientific, this work may appear too common-place — to the uninstructed, too enlarged or abstruse. It was not intended to reconcile impossibilities. The first must look to elaborate or complete treatises for the fullest information on the various subjects comprehended in this general summary. To the last, it must be answered, that what is here communicated, is important to be known; that modern agriculture, like all other progressive modern sciences and arts, has necessarily introduced new terms, for the explanation of new principles and new practices; and the former must be learned before the latter can be comprehended.

To the Young Farmers of the United States, this work is respectfully dedicated, with the hope, that it will add its mite in sustaining and carrying forward the great agricultural improvements of the present day. To agriculture, "the most healthful, the most useful, the most noble employment of man," rather than to any other, or perhaps, to all others combined, must we look for the permanent strength, the glory and happiness of our great Republic.

INTRODUCTION.

Agriculture in its most extensive sense, may be defined' the cultivation of the earth with a reference to the production of vegetables, and the conversion of portions of them into animals and a variety of forms, which are the best adapted to the wants of mankind. It is appropriately distinguished by numerous subdivisions.

Tillage Husbandry consists in the raising of grain, roots and other products, which require the extensive use of the plow and harrow to prepare the ground for annual sowing and planting.

Grazing is limited to the pasturing and winter feeding of farm stock, and it requires that the land appropriated to this purpose, should be kept in pasturage for summer food, and in meadows to yield the hay necessary for winter's use. In its strictly technical meaning, grazing implies the rearing of farm stock till they have attained sufficient maturity for a profitable market, as far as this maturity can be secured on grass and hay. It however, properly embraces in its minor divisions, the keeping of cows for the purposes of a dairy, and the support of flocks for the production of wool.

Feeding in its agricultural signification, consists in stall fattening animals, and it is properly connected with tillage husbandry, by which grain and roots are produced, and by their free use, animals can be brought to a higher condition or *ripeness*, and they will thus command a much better price in market, than if fed exclusively on grass or hay.

Breeding, technically defined, is restricted to the production of choice animals for use as future propagators, by the judicious selection and crossing of the best specimens of the various distinct breeds of domestic stock.

Horticulture embraces the entire departments of gardening and arboriculture or the cultivation of trees, which is again variously subdivided

By *Planting*, (or the occupation of planters,) is understood the cultivation of extensive farms or plantations, for the exclusive production of one or more commercial staples; as cotton, sugar, rice, tobacco, indigo, &c., and their preparation for a distant market. The term is peculiarly sectional, and its use, so far as adopted in this country, is limited to the Southern part of it.

All of these, and various other occupations connected with the cultivation of the earth are comprehended under the general head of Agriculture.

Besides the varied practical knowledge which is indispensable to the proper management of every department of agriculture, its general principles and theoretical relations require a familiarity with the elements of History, Geology, Chemistry, Botany, Anatomy, Physiology, and Mechanics; and in their ultimate connexion, they involve no inconsiderable share of the entire circle of human knowledge and science.

In view of its intricacy, its magnitude, and its importance to the human race, we cannot fail to be struck with the peculiar wisdom of Deity in assigning to man this occupation, when a far-seeing and vigorous intellect fitted him to scan with unerring certainty and precision, the visible works of his Creator, and trace their causes and effects through all their varied relations. It was while in the sinless perfection of his original nature, when "the Lord God put him into the garden of Eden, to dress it and to keep it," and agriculture was his sole occupation, that his godlike intelligence enabled him, instinctively to give appropriate names, indicative of

their true nature or character, "to all cattle, and to the fowl of the air, and to every beast of the field;" and so just and accurate was his perception, that "whatsoever he called every living creature, that was the name thereof."

In our present imperfect condition, a beneficent Providence has not reserved a moderate success in Agriculture, exclusively to the exercise of a high degree of intelligence. His laws have been so kindly framed, that the hand even of uninstructed toil, may receive some requital in remunerating harvests; while their utmost fulness can be anticipated, only where corporeal efforts are directed by the highest intelligence.

The indispensable necessity of an advanced agriculture to the comforts and wealth, and indeed, to the very existence of a great nation, renders it an object peculiarly worthy the attention and regard of the legislative power. In looking to the history both of ancient and modern times, we find, that wherever a people have risen to enduring eminence, they have seduously encouraged and protected this right arm of their strength. Examples need not be given for they abound in every page of their civil polity.

Our own country has not been wanting in a moderate regard for Agriculture. By wise legislation in our National Congress, every item of extensive agricultural production within the United States, with the single exception of the inferior wools, is believed to be fully protected from foreign competition, by an unyielding and perfectly adequate impost on all such articles, as would otherwise enter into a successful rivalry with them from abroad. Many of our subordinate, or State Legislatures have also, by liberal provisions, given such encouragement to various objects, as they deemed necessary to develope the agricultural resources within their jurisdiction. Such have been the appropriations for numerous Geological and other state surveys; the bounties on different articles, as silk, hemp, and some others; and occa-

sionally a small gratuity to encourage the formation and support of State and County Agricultural Societies.

But while we would not be unmindful of what has heretofore been effected, our duty compels us to assert, that much yet remains to be done. A single suggestion for the action of the general government and states, is all that our limits will permit us to make.

The organization of a National Board of Agriculture, composed of able and intelligent men, expressly selected for this purpose, whose sole duty it should be to collect all information and statistics on the subject, and arrange and spread them before the people; to introduce new and valuable foreign plants, adapted to our soil and climate; suggest improved methods of cultivation; point out new avenues for the profitable disposal of our surplus products; and recommend such laws or their modification, as might best subserve this interest; in short, who should stand as sentinels and defenders on the watch-tower of this great citadel — this is the lofty duty, and should be esteemed the peculiar privilege of American Legislation to accomplish. This was a favorite, yet never a fully digested plan of Washington, the promptings of whose mind, were never followed but for his country's good.

From the Legislatures of the individual States a less commanding, but not less beneficial duty is required. Restrictions wisely imposed upon the general government, limit its action to such measures only as are essential to the general welfare, and such as cannot properly be accomplished by any more circumscribed authority. More liberal and enlarged grants from the people, (the only legitimate source of power with the farmers and their fellow citizens of the United States,) give to the State Legislatures, the power of doing all which their constituents choose to have effected for their own benefit.

Education, in all its branches, is under their exclusive control; and to endow and foster every institution which has

a tendency to raise and improve the intellectual, the moral and the social condition of the people, has ever been their cherished policy. Yet up to this time, no institution expressly designed for the professional education of farmers, has ever been established in this country. That far-seeing wisdom, which characterises the consummate statesman, which regards the future equally with the present and past, has halted upon the threshhold of the great temple of agricultural science, whose ample and enduring foundations have been commenced by the united efforts of the men of genius throughout both hemispheres. To aid with every means in their power in laying these foundations broad and deep, to elevate its superstructure, to rear its mighty columns, and adorn its graceful capitals, would seem, most properly to come entirely within the province of the representatives of intelligent freemen, the great business of whose lives is the practice of agriculture.

In addition to continuing, and making more general and comprehensive the encouragement for other objects heretofore considered ; it is the duty of each of the larger States of the Union, liberally to endow and organise an Agricultural College, and insure its successful operation within its jurisdiction. Connected with them, should be example and experimental farms, where the suggestions of science should be amply tested and carried out before submitting them to the public. The most competent men at home and abroad should be invited to fill a professional chair; and if money would tempt a Liebig, a Boussingault, a Johnston, or a Playfair, to leave the investigations of European soils and products, and devote all their mind and energies to the development of American Husbandry, it should be freely given.

These institutions should be schools for the teachers equally with the taught ; and their liberally appointed laboratories and collections, should contain every available means for the discovery of what is yet hidden, as well as for the further development of what is already partially known. Minor

institutions should of course be established at different and remote points, to scatter the elements of agricultural knowledge broad-cast over the land, and bring them within the reach of the poorest citizens and the humblest capacities.

By such a liberal and enlightened course, we should not only incalculably augment the productive agricultural energies of our own country, but we should also in part, repay to the world at large, the obligations under which we now rest, for having appropriated numerous and important discoveries and improvements from abroad. If we have the ability, which none can doubt, we should make it a point of honor to return in kind, the liberal advances we have thus received.

It is to the rising generation these suggestions are made; the risen are not yet prepared for their acceptance. The latter have been educated, and become habituated to different and more partial influences. By their industry, intelligence, and energy, displayed in numberless ways, and especially by their protection of American labor, they have accomplished much for their own and their country's welfare — they are resolved to leave this glory for their successors.

BUFFALO, N. Y. JUNE, 1846.

AMERICAN AGRICULTURE.

CHAPTER I.

SOILS.

Soils are those portions of the earth's surface, which contain a mixture of mineral and vegetable or animal substances, in such proportions as adapt them to the support of vegetation. Rocks are the original basis of all soils, which by the convulsions of nature, or the less violent but long continued and equally efficient action of air, moisture and frost, have been broken into fragments more or less minute. There are various gradations of these changes.

The texture of Soils.—Some rocks exist in large boulders or rounded stones, that thickly overspread the surface and mingle themselves with the earth beneath it, giving to it the name of a rocky soil. The smaller sizes but equal prevalence of the same materials, give to the surface where they abound, the character of a stony soil. A third and more minute division is called a gravelly soil; a fourth is a sandy soil; a fifth constitutes a loam; and a sixth, in which the particles of earth are reduced to their greatest fineness, is known under the name of a clay soil. The two first mentioned, are not properly distinct soils, as the only support of any profitable vegetation, is to be found in the finer earth in which the rocks and stones are embedded. In frequent instances, they materially benefit the crops, in the influence produced by the shade, moisture, and protection from winds, afforded by them; and by the gradual decomposition of such as contain lime, potash and other fertilising materials, they contribute to the support of the soil. This last effect is aided by the apparently worthless vegetable life which they yield to the living mosses that cling to their sides and every

where penetrate their fissures, thus imperceptibly corroding the solid structures and preparing them for future usefulness as soils. If we add to the above, a peat or vegetable soil, we shall have the material divisions of soils, as distinguished by their texture.

OTHER CLASSIFICATIONS OF SOILS.— Soils are also distinguished by their tendency to absorb and retain water, gravel and sand holding very little, while clay and peat readily absorb and retain a great deal; by their constant saturation from perennial springs, which are called springy soils; by the quantity of vegetable and animal matter they contain; by their porosity or adhesiveness; by their chemical character, whether silicious, argillaceous or calcareous; by the quality and nature of the vegetation they sustain; and lastly, and by far the most important, they are distinguished by their fertility or barrenness, the result of the proper adjustment and combination of most of the conditions enumerated. Deserts of sands, layers of rocks, stone or pure gravel, and beds of marl and peat are not soils, though containing many of their most important elements.

It is apparent to the most casual observer, that soils frequently and by almost imperceptible degrees, change from one character to another, and that no classification therefore, however minute, will suffice to distinguish each. Some obvious yet simple distinctions, which are usually recognised, must nevertheless be assumed for future reference. For this purpose, and to avoid unnecessary deviations from what should be a common standard, we shall adopt the arrangements as made by Professor Johnston, which is based principally upon their chemical constituents.

" 1°. *Pure clay* (pipe-clay) consisting of about 60 of silica and 40 of alumina and oxide of iron, for the *most part* chemically combined. It allows no silicious sand to subside when diffused through water, and rarely forms any extent of soil.

" 2°. *Strongest clay soil* (tile-clay, unctuous clay) consists of pure clay mixed with 5 to 15 per cent. of a silicious sand, which can be separated from it by boiling and decantation.

" 3°. *Clay loam* differs from a clay soil, in allowing from 15 to 30 per cent. of fine sand to be separated from it by washing, as above described. By this admixture of sand, its parts are mechanically separated, and hence its freer and more friable nature.

" 4°. A *loamy soil* deposits from 30 to 60 per cent. of sand by mechanical washing.

"5°. A *sandy loam* leaves from 60 to 90 per cent. of sand, and

"6°. A *sandy soil* contains no more than 10 per cent. of pure clay.

"The mode of examining with the view of naming soils, as above, is very simple. It is only necessary to spread a weighed quantity of the soil in a thin layer upon writing paper, and, to dry it for an hour or two in an oven or upon a hot plate, the heat of which is not sufficient to discolor the paper — the loss of weight gives the water it contained. While this is drying, a second weighed portion may be boiled or otherwise thoroughly incorporated with water, and the whole then poured into a vessel, in which the heavy sandy parts are allowed to subside until the fine clay is beginning to settle also. This point must be carefully watched, the liquid then poured off, the sand collected, dried as before upon paper, and again weighed. This weight is the quantity of sand in the known weight of *moist* soil, which by the previous experiment has been found to contain a certain quantity of water.

"Thus, suppose two portions, each 200 grs., are weighed, and the one in the oven loses 50 grs. of water, and the other leaves 60 grs. of sand,— then, the 200 grs. of *moist* are equal to 150 of *dry*, and this 150 of dry soil contain 60 of sand, or 40 in 100 (40 per cent.). It would, therefore, be properly called a *loam*, or *loamy* soil.

"But the above classification has reference only to the clay and sand, while we know that lime is an important constituent of soils, of which they are seldom entirely destitute. We have, therefore,

"7°. *Marly soils*, in which the proportion of lime is more than 5 but does not exceed 20 per cent. of the whole weight of the dry soil. The marl is a sandy, loamy, or clay marl, according as the proportion of clay it contains would place it under the one or other denomination, supposing it to be entirely free from lime, or not to contain more than 5 per cent., and

"8°. *Calcareous soils*, in which the lime exceeding 20 per cent. becomes the distinguishing constituent. These are also calcareous clays, calcareous loams, or calcareous sands, according to the proportion of clay and sand which are present in them.

"The determination of the lime also, when it exceeds 5 per cent., is attended with no difficulty.

"To 100 grs. of the dry soil diffused through half a pint of cold water, add half a wine glass-full of muriatic acid (the spirit of salt of the shops), stir it occasionally during the day, and let it stand over night to settle. Pour off the clear liquor in the morning and fill up the vessel with water, to wash away the excess of acid. When the water is again clear, pour it off, dry the soil and weigh it — the loss will amount generally to about one per cent. more than the quantity of lime present. The result will be sufficiently near, however, for the purposes of classification. If the loss exceed 5 grs. from 100 of the dry soil, it may be classed among the marls, if more than 20 grs. among the calcareous soils.

"Lastly, vegetable matter is sometimes the characteristic of a soil, which gives rise to a further division of

"9°. *Vegetable moulds*, which are of various kinds, from the garden mould, which contains from 5 to 10 per cent., to the peaty soil, in which the organic matter may amount to 60 or 70. These soils also are clayey, loamy, or sandy, according to the predominant character of the earthy admixtures.

"The method of determining the amount of vegetable matter for the purposes of classification, is to dry the soil well in an oven, and weigh it; then to heat it to dull redness over a lamp or a bright fire till the combustible matter is burned away. The loss on again weighing is the quantity of organic matter."

The foregoing are only such general divisions as possess properties sufficiently common to each, to require a treatment nearly similar. Besides their principal component parts, every soil must contain in greater or less quantities, all the elements which enter into the composition of vegetables. They may have certain substances which are not necessary to vegetable life, and some one or all of such as are, may be contained in excess; yet to sustain a healthy prolific vegetation, they must hold, and in a form fitted to its support, silex alumina, carbonate of lime, sulphate of lime, potash, soda, magnesia, sulphur, phosphorus, oxide of iron, manganese, chlorine, and probably iodine. These are called the inorganic, or earthy parts of soils, as they are found almost exclusively in combination with earths, salts, or minerals. They however constitute from less than 0.5 (one half of one) to over 10 per cent of all vegetables. In addition to these, fertile soils must also contain, carbon, oxygen, nitrogen and hydrogen, which are called the organic parts of soils, from

their great preponderance in vegetables and animals, of which they constitute from about 90, to over 99 per cent of their entire substance.

CLAY SOILS—THEIR CHARACTERISTICS AND TREATMENT. —Clay soils are usually denominated cold and wet, from their strong affinity to water, which they generally hold in too great excess for rapid or luxuriant vegetation. The alumina which exists in clay, not only combines with water forming a chemical compound, but the minute division of its particles and their consequent compactness, oppose serious obstacles to the escape of such as rests in or upon it. Hence the necessity of placing it in a condition to obviate these essential defects.

The most effectual method of disposing of the surplus water in clay soils, is by underdraining. This draws off rapidly yet by imperceptible degrees, all the excess of water, and opens it to the free admission of atmospheric air; and this, in its passage through the soil, imparts heat and such of the gases it contains, as are useful in sustaining vegetation. When these are not constructed, open drains should be formed wherever water stands after rains. The slight elevation and depression of the surface made by careful plowing, will probably be sufficient, if they terminate in some ravine or artificial ditch, and have size and declivity enough to pass off the water rapidly.

Clay soils are greatly improved by coarse vegetable manures, straw, corn-stalks, chips, &c., which tend to the separation of its particles. The addition of sand is very beneficial, but this is too expensive for large fields. Lime is also a valuable material for a clay soil, as by the chemical combinations which are thereby induced, the extreme tenacity of the soil is broken up, while the lime adds an ingredient of fertility, not before possessed by it perhaps, to an adequate extent. Gypsum has the same effect in a more powerful degree. Paring and burning (by which the surface containing vegetable matter is collected into heaps and fired, reducing the mass to a charred heap, which is again spread over and mixed with the soil,) produce the same result. This is a practice which has been long in use in different parts of Europe, and although attended with immediate and powerful results, it is too expensive for general introduction into a country, where labor is high, and land and its products comparatively cheap.

The plowing of clay lands for spring crops should be done in the autumn if practicable, by which their adhesiveness is temporarily destroyed, the earth is finely pulverized by the frost, and they are left in the finest condition for early spring sowing, and without additional working. If plowed in the spring, it should be done when they are neither too wet or dry; if the former, the earth subsequently bakes, and for a long time it is almost impenetrable to the hoe or the teeth of the harrow; if too dry, they are so compact as to be turned over only with great effort, and then in solid lumps. The action of the atmosphere, will pulverize these masses of baked earth after a time, but not sufficiently early for the convenience or advantage of such crops as are intended immediately to follow the plowing.

No soils are so tenacious of the manures which may be incorporated with them as the clays. They form an intimate combination, both mechanical and chemical,* and hold them securely against waste from drainage or evaporation for an indefinite time, till the growing crops demand them. They also greedily seize upon and hoard up all such fertilizing principles as are conveyed to them by the air and rains. We may mention as an example of their efficiency

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* By *mechanical* in the sense above used, is understood the external relation of bodies, which is nearly equivalent in its meaning in this connexion, to artificial. Thus the clay envelopes the manures, and from its impervious nature, it shields it from escape either by drainage or evaporation, and almost as effectually as if it were enclosed in an earthern vessel.

By *chemical* is meant, its internal or constitutional character. Thus clay not only absorbs the gases which are brought into contact with it from manures, from moisture and from air, as a sponge absorbs water; but it also forms new combinations with them, which change the original nature of these elementary principles, and from light evanescent gases, they becone component parts of solid bodies, in which condition they are retained till exhausted by the growing vegetation.

These terms are important, and should be clearly understood. For the sake of aiding the young student, we will give some further examples. If we take a piece of crystalized marble, compact uncrystalized limestone, and chalk, we shall have three substances exactly alike in their *chemical* character; for they are all combinations of carbonic acid and lime associated together in precisely the same proportions. But in their external arrangements, as they appear in a recent fracture to the eye and touch, that is in their *mechanical* arrangements, they are all totally dissimilar.

Again—If we take the pure lime (quick lime) that is obtained from each of the foregoing by subjecting them to an intense heat, by which the carbonic acid is expelled, and pour upon it nearly one third of its weight of water, great heat is developed and the lime both mechanically absorbs, and chemically combines with it, forming a new compound, or salt, which is a hydrate of lime.

If sand (mostly silex) be added to the lime with water, and *mechanically* mixed or stirred together and allowed to remain for a sufficient time, they will combine *chemically*, forming silicate of lime, (the common mortar of stone masons.)

Sand (silex) stirred in with clay (an impure alumina) is *mechanically* mixed; if then subject to a strong heat as in making brick, they become *chemically* united, forming silicate of alumina, inseparable by any human means short of the chemist's crucible. If we divide or separate a stick by splitting or cutting, it is a mechanical; and it by burning or charring, it is a chemical change. Thus every alteration either in nature or art is referable to one of the above conditions or changes.

in abstracting vegetable nutrition from the atmosphere, that many of them when thrown up from a great depth below the surface, and entirely destitute of organic remains, (vegetable or animal matter,) after an exposure for some months to its meliorating influence, become capable of bearing large crops without the aid of manure. This is particularly true of the clays which rest on the Onondaga limestone, an extensive group occupying the central and north-western part of New-York.

The clays are admirably adapted to the production of most of the grains; and the red and white clovers cultivated in the United States. These they yield in great profusion and of the best quality; and so peculiarly suited are they to meadows and pasturage, that they are styled by way of eminence, *grass lands.* They are justly characterised as strong and lasting soils, and when properly managed and put to their appropriate use, they are esteemed as among the choicest of the farmer's acres.

Sandy soils and their management.—The character and treatment of sandy soils, are in almost every particular the reverse of those of clay. They do not possess the property of adhesiveness, and they have but little affinity for water, which escapes from them almost as soon as it falls. They have but a slight hold upon the manures which are diffused through them; they are loose in their texture, and may be plowed at any time with equal advantage, provided the sowing or planting is to follow immediately.

As clay soils are much benefitted by a mixture of sand, so likewise are sandy soils greatly improved by the addition of clay, yet in a much higher degree; for though it would never pay, as a general rule, to add sand to clay, yet the addition of a few loads of the stiffest clay to a light sand, would in almost every instance much more than compensate for the trouble and expense. For this purpose, the clay should be thinly spread in autumn upon sward land previously plowed, and the winter's frost will effectually separate the particles. It should then be harrowed thoroughly and deeply in the spring, and subsequently plowed if necessary. Such a dressing on a light crawling land, is more than equivalent to an equal quantity of the best manure, and will be permanent in its effects. Clay and sand are necessary to each other, as they both contain qualities which are essential to a good soil; and that will always be found the best, which has the proper proportion of each.

Sandy soils are improved by the frequent use of a heavy roller; it cannot be used too often. They require to be made more compact, and any treatment that secures this object, will be advantageous.

Lime, by its chemical action on the constituents of soils, while it separates clay, renders sand more adhesive; and when cheaply obtained, it is always a profitable dressing for sandy soils, to the full amount they may require. Gypsum, in considerable quantities, has an effect similar to lime, both on clay and sand; and when added in smaller portions, produces a striking increase in the crops of sandy soils. Clay marls containing either carbonate, sulphate, or phosphate of lime, are of great value to sandy soils. Equally beneficial are ashes leached or unleached, peat, or vegetable manures of any kind. Some calcareous sands, containing a large proportion of lime, like those of Egypt and extensive regions in the Barbary States, will produce luxuriantly, if supplied with a slight addition of manure and an abundance of water. Sandy soils can never be profitably cultivated till they have acquired sufficient compactness and fertility to sustain a good growth of grass or clover; and when once brought to this condition, they are among the most valuable.

They are at all times, easily plowed and worked; they require no draining; and though light and dry, are quick and kindly soils, giving an immediate and full return for the labor and manure bestowed upon them. When in a condition to produce grass, sheep are admirably adapted to preserve and augment their fertility, and by their incessant migrations over it, their sharp hoofs pack the surface closely, producing the same effect as the roller.

Gravelly soils, are in some respects similar to sand, but much less desirable, being appropriately termed *hungry*. They are also like the latter, peculiarly leachy, but in an increased degree, permitting the rapid escape of manures both by evaporation and drainage. Such as are calcareous or composed of limestone pebbles, are in a great measure not subject to those objections; as the disposing affinities of the lime, (of which enough will be found to exist in the soil in a finely comminuted or divided state, which in this condition is enabled to act efficiently,) have a tendency to retain the vegetable matters, thus compacting the soil, and holding whatever pabulum or food of plants, may from time

to time be given to it for the wants of future crops. Unless of this latter description, gravelly soils, should not be subjected to tillage; but appropriated to pasturage, when sheep will keep them in the best and most profitable condition of which they are capable.

LOAMY SOILS being intermediate between clay and sand, possess characteristics and require a treatment approximating to one or the other, according to the predominance of either quality. They are among the most desirable soils for the various purposes of agriculture.

MARLY AND CALCAREOUS SOILS, have always a full supply of lime, and like the loams, they frequently incline towards a clay or sand, requiring a treatment corresponding to their character. Putrescent and vegetable manures increase their fertility and they are held with great tenacity till exhausted by crops. In durability or lastingness they cannot be exceeded.

ALLUVIAL SOILS, are such as have been formed from the washing of streams. They vary in their characteristics, from a mixed clay to an almost pure sand; but generally they combine the components of soils in such proportions as are designated by *loamy soils*, or *sandy loams*. When thus formed they are exceedingly fertile, and if subject to the annual overflow of a stream, having its sources far above them, they usually receive such an addition to their productiveness, as enables them to yield large crops perpetually without further manuring.

They are for the most part easily worked, and are suited to the various purposes of tillage and meadows; but when exposed to overflowing, it is safer to keep them in grass, as this crop is less liable to injury by a freshet; and where subject to washing from the same cause, a well matted sod is the best protection which can be offered against it. Many of the natural grasses which come into these meadows yield a fodder of the highest value

PEATY SOILS. These are composed almost wholly of peat, and are frequently called vegetable soils. They are extensively diffused between the latitudes of 42° and 60° north, at a level with the ocean, and are frequently found in much lower latitudes, when the elevation of the surface produces a corresponding temperature. They generally occupy low swampy levels, but sometimes exist on slight northern declivities, where the water in its descent is arrested by a succession of basin shaped cavities.

Their peaty character is acquired by the growth and partial decay through successive ages, of various aquatic plants, the principal being the sphagnums and lichens. In swamps, many of which, were probably small lakes in their origin, the peat is found of an unknown depth, reaching in some instances beyond 30 and 40 feet. On declivities and occasional levels, the peat is sometimes only a few inches in thickness. It is of a blackish or dark brown color, and exists in various stages of decay, from the almost perfect state of fallen stumps and leaves, to an imperfectly defined, ligneous mass, or even an impalpable powder.

In its natural state, it is totally unfit for any profitable vegetation, being saturated with water, of an antiseptic nature which effectually resists putrefaction or decay. When thrown out of its native bed and exposed to drain for a few months, much of it is fit for fuel; and it is always of advantage to the muck heaps, as an absorbent of the liquid and gaseous portions of animal and other volatile manures; or it is of great utility when applied alone to a dry, gravelly or sandy soil.

Cultivation of peat soils. When it is desirable to cultivate a peat soil, the first process is to drain it effectually of all the moisture which has given to it, and sustained its present character. The drains mnst be made sufficiently near, and on every side of it; and so deep as to prevent any injurious capillary attraction of the water to the surface. When it has been properly drained, the hummocks if any, must be cut up with the mattock or spade and thrown into heaps, and burnt after they are sufficiently dried, and the ashes scattered over the surface. These afford the best top dressing it can receive. Sand or fine gravel, with a thorough dressing of barn-yard manure and effete lime, should then be added. On some of these, according as their composition approaches to ordinary soils, good crops of oats, corn, roots, &c., may be grown, but they are better suited to meadows, and when thus prepared, they will yield great burthens of clover, timothy, red top, and such of the other grasses as are adapted to moist soils. Subsequent dressings of sand, lime, manure and wood ashes, or of all combined, may be afterwards required when the crops are deficient, or the grasses degenerate.

Peat contains a large proportion of carbon, and the silicates in which such soils are deficient, and which they procure only in small proportions from the farm-yard manure, but more

largely from the sand or gravel, are essential to furnish an adequate coating for corn stalks, straw and the valuable grasses. As they are exhausted they must be again supplied or the crops will fail. Besides yielding an important food to the crop, lime is essential to produce decomposition in the mass of vegetable matter, as well as to combine with and aid in furnishing to the growing plants, such of their food as the atmosphere contains. Ashes are one of the best applications, as they possess the silicates, lime, potash, and other inorganic materials of plants in great abundance, and in a form readily adapted to vegetable nutrition. Gypsum is also a valuable manure for peaty soils.

SUBSOILS AND THEIR MANAGEMENT.

The efficiency of soils for producing good crops, depends much on the subsoil. If this consists of impervious clay or hard-pan, so as to oppose a ready escape to the water, it is evident the accumulation of the heavy rains, will materially injure the vegetation above them; for it is certain that while nothing is more essential to productive crops than an adequate supply of moisture to the roots, nothing is more injurious than their immersion in stagnant water. When such is the character of the subsoil, it should be under-drained if possible, or if this be not practicable, it should be broken up and loosened by the use of the subsoil plow.

A variety of plows have been constructed for this purpose, but unless it be intended to deepen the soil by an admixture of manures, care should be taken to avoid bringing up the subsoil to mix with that on the surface. In addition to the more ready escape of water thus secured by breaking it up, the air is also admitted, which enables the roots to strike deeper, and draw their nourishment from a much greater depth. The increased distance through which the roots penetrate, furnishes them with additional moisture during a season of drought, thereby securing a luxuriant crop when it might otherwise be destroyed. This is frequently a great item in the profit of the farmer; as besides the increase of crop which follows a dry hot season when a full supply of moisture is furnished, the product is usually of better quality; and the general deficiency of agricultural produce which ensues from seasons of drought, makes his own more valuable.

As a result of this practice, there is also a gradual increase in the depth of the soil, as the fine and more soluble particles of the richer materials above are constantly working

down and enriching the loosened earth below; and in time this becomes good soil, which in proportion to its depth, increases the area from which the roots derive their nutriment. So manifest are the advantages which have followed the use of subsoil plows, that they have been extensively introduced of late years among the indispensable tools of the better class of agriculturists.

When the subsoil is loose and leechy, consisting of an excess of sand or gravel, thereby allowing the too ready escape of moisture and the soluble portions of manures, the subsoil plow is not only unnecessary, but positively injurious. In this case the surface soil should be somewhat deepened by the addition of vegetable manures, so as to afford a greater depth, through which they must settle before they can get beyond the reach of the roots; and the supply of moisture is thereby much augmented. It is better however, to keep lands of this character in wood, or permanent pasture. They are at best ungrateful soils, and make a poor return for the labor and manure bestowed upon them.

If there be a diversity in the character of the sub and surface soil, one being inclined to sand and gravel, and the other to marl or clay, a great improvement will be secured by allowing the plow to reach so far down as to bring up and incorporate with the soil, some of the ingredients in which it is wanting. This admixture is also of remarkable benefit in old or long cultivated soils, which have become deficient in inorganic matters and in their texture.

The effect of long continued cultivation, besides exhausting what is essential to the earthy part of plants, is to break down the coarser particles of the soil, by the mechanical action of the plow, harrow, &c., and in a much more rapid degree, by the chemical combinations which cultivation and manuring produce. A few years suffice to exhibit, striking examples in the formation and decomposition of rocks and stones. Stalactites and various specimens of limestone, indurated clays, sandstone and breccias or pudding stones, are formed in favorable circumstances, almost under our eye; while some limestones, shales, sandstones, &c., break down in large masses annually, from the combined effect of moisture, heat and frost. The same changes on a smaller scale, are constantly going forward in the soil, and much more rapidly while under cultivation. The general tendency of these surface changes is towards pulverization. The particles forming the soil, from the impalpable mite of dust, to the

large pebbles, and even stones and rocks, are continually broken up by the combined action of the vital roots and the constituents of soils, by which new elements of vegetable food are developed and become available, and in a form so minute, as to be imbibed by the spongioles of the roots, and by the absorbent vessels, they are afterwards distributed in their appropriate places in the plant. Where this action has been going on for a long period, a manifestly beneficial effect has immediately followed from bringing up and mixing with the superficial earth, portions of the subsoil which have never before been subject to cultivation.

A subsoil which is permeable to water, is sometimes imperceptibly beneficial to vegetation, not only by allowing the latent moisture to ascend and yield a necessary supply to the plants, but a moisture frequently charged with lime and various saline matters, which the capillary attraction brings from remote depths below the surface. It is probably from this cause, that some soils produce crops far beyond the yield which might be reasonably looked for from the fertilizing materials actually contained in them. This operation is rapidly going forward during the heat of summer. The water thus charged with saline matters ascends and evaporates at and below the surface, leaving them diffused throughout the soil. After long continued dry weather, a thin white coating of these salts is frequently discernible on the ground.

Where rain seldom or never falls, this result is noticeable in numerous and sometimes extensive beds of quiescent (not shifting) sand. Deposits ofttimes occur several inches in thickness. Such are the extensive beds of impure muriate of soda and other salts in the arid deserts of California; in the southern parts of Oregon; the nitrates found in India, Egypt, Peru, and various other parts of the world.

ADDITIONAL PROPERTIES OF SOILS.

Besides the qualities of soils already noticed, there are several physical conditions which affect their value. They should be of sufficient depth, friable, or easily pulverized, they should possess the right color, and be susceptible of the proper admission and escape of heat, air, and moisture.

Jethro Tull, who wrote more than a century ago on the subject of agriculture, maintained that if a soil be worked to a proper depth and perfectly well pulverized, nothing more is necessary to insure an indefinite succession of the most luxuriant crops without the aid of manures; and it must be

confessed his practice, gave some apparently strong confirmations of his theory. By carrying tillage far below the surface, thus securing the minute division of the earth, and rendering it permeable to the roots, he insured the free access of air and moisture, which are among the first and most important requisites in the growth of vegetables.

But Tull wrote before agriculture became a science, and omitted to estimate the large amount of fertile ingredients which every crop takes out of the soil, and which can only be supplied by the addition of fresh materials. A succession of crops would therefore, so far reduce the soil as to render it necessary to add manures, or vegetation must inevitably fail. This careful laborious practice could only for the time being, enhance the crop and prolong its available supplies; yet in accomplishing even this object, his example is worthy of the imitation of every tiller of the soil.

Friableness of the soil, is a quality equally removed from the adhesiveness of strong clay, or the openness of loose sand. Good loams, and fertile alluvial soils, always possess this property. When stirred by the plow, the spade, or the hoe, the earth should fall and crumble readily, although wet. Such a condition secures a ready admission to the roots, which thus easily pervade the soil, and draw from it in every direction, their necessary support. Under draining and the addition of coarse manures to clay, fermented manures and ashes to sand, and lime and gypsum to both, will materially enhance their friableness.

Color is an essential feature in soils, and like friableness, it has an important relation to their capacity for heat and moisture. Dark colored earths, and black in the highest degree, absorb heat more rapidly than any other when exposed to a temperature above their own, and it escapes with equal readiness when their relative temperatere is reversed.

A rough pulverised surface, which is seen in the minute inequalities of a friable soil, produces the same result. During the heat of the day, especially when the sun's rays fall upon the earth, the dark friable soil imbibes the heat freely, and transmits it to the remotest roots, thus securing warmth to the plant, which is one of the necessary conditions of its growth. When the temperature of the air falls, on the approach of evening, a reversed action in the soil takes place by which the heat as rapidly escapes. This immediately brings the surface to "the dew point" and secures a copious

deposit of moisture, which a friable soil speedily conveys to every part of the roots.

The dew point is attained when the surface of any object is below the temperature of the surrounding air; and the careful observer will not fail to discover the formation of dew, not only after the sun has risen, and long before he sinks below the horizon, when the condition above indicated exists; but sometimes even in the fervor of a mid-day sun, when the thick corn or any luxuriant vegetable growth repels his fierce rays from the earth. In many instances, the rank, dark growing crops themselves, when shielded from the sun's rays by their overspreading tops, become rapid condensers of atmospheric vapor, and the plant drinks in at every pore, the wholesome and nutritious aliment, and frequently collects a surplus, which streams down its sides to the thirsty soil beneath. The principle is further illustrated by the deposit of moisture in large globules on the surface of any vessel or object in the shade, which is sensibly below the surrounding temperature, as is shown by an earthen or metallic vessel filled with cold water and set in a warm room on a summer's day.

The proper capacity of soils for imbibing and parting with moisture gives them another decided advantage over others which have it in an imperfect degree; as it is found by recent experiments, that rich porous soils which are readily penetrated by water and air, absorb the nutritious gases, (oxygen, nitrogen, and their compounds, nitric and carbonic acid, ammonia, &c.) largely from the atmosphere, and that they do this to an appreciable extent, only while moist. The effect of this will readily be estimated, from the well known beneficial influence exerted on the growing plant by the presence of these important elements.

Light colored clays, marls and sands, are neither in their mechanical texture, friableness or color, the best suited to promote the growth of plants. *Peat soils*, from their too great affinity for water in their natural condition, are even less adapted to the object than either of the preceding.

Schubler has found that during 12 hours in the night, when the air was moist, 1000 lbs of entirely dry quartz* or common sand, did not gain a pound; calcareous sand gained 2 lbs; loamy soil 21 lbs; clay loam 25 lbs; such as were

* Quartz as analyzed by Bergman, gave 93 per cent. of silex; 6 of alumina; and 1 of oxide of iron. It comes so near a pure silica, that in treating of it agriculturally, we speak of it as silex or silica.

rich in vegetable mould still more, while peats absorbed a much larger per cent. than either.

Davy also found, that the same quantity of very fertile and perfectly dry soil on exposure gained 18 lbs in one hour; a good sandy soil under the same circumstances absorbed 11 pounds; a coarse inferior sand, 8 lbs, and an almost worthless heath gained but 3 lbs.

The power of soils in retaining water, is somewhat proportionate to their power of absorbing it:—

				Of its own weight.	
Quartz sand	is saturated	when	it contains	24	per ct.
Calcareous sand	"	"	"	28	"
Loamy soil	"	"	"	38	"
Clay loam	"	"	"	47	"
Peat (about)	"	"	"	80	"

It is thus evident that perfection is not obtained in either sandy, gravelly, clay or peat soils, as they are characterized in the classification we have assumed. It is only when they have been improved by partial admixture with each other, and charged with the proper quantity of vegetable manures, and the salts which are requisite for their fertility; when they have been drained wherever necessary to free them from stagnant water, whether upon or within the soil, or to remove any noxious springs which sometimes contain matters in solution injurious to vegetation; and finally when the subsoil is in the proper condition to facilitate the free passage of the roots in every direction—it is only when all these conditions exist, that the fullest products from soils can be realized.

It is absolutely essential to profitable cultivation, that all the earthy substances required by the crops should exist in the soil in sufficient quantities, and in an accessible form to supply its wants. The proportions may be various, one sometimes greatly predominating over another, as is sufficiently obvious in the equally productive powers of good clays, sands and peats; yet in every instance it will be found, unless owing to a heavy coating of manures, and a peculiarly favorable season, that they can be relied on for such constant results, only when they have been so ameliorated as to approximate towards the character of loams.

The following is an analysis of three specimens of very fertile soils, made by Sprengel :

	Soil near Osterbruch.	From the banks of the Weser. near Hoya.	near Weserbe.
Silica, Quartz, Sand and Silicates	84·510	71·849	83·318
Alumina	6·435	9·350	3·085
Oxides of Iron . . .	2 395	5·410	5 840
Oxide of Manganese . .	0·450	0·925	0·620
Lime	0·740	0·987	0·720
Magnesia	0·525	0·245	0 120
Potash and Soda extracted by water	0·009	0·007	0·005
Phosphoric Acid . .	0·120	0·131	0·065
Sulphuric Acid	0·046	0·174	0·025
Chlorine in common Salt .	0·006	0·002	0·006
Humic Acid	0·780	1 270	0·800
Insoluble Humus . . .	2·995	7·550	4·126
Organic matters containing nitrogen	0·960	2·000	1·220
Water	0 029	0·100	0·150
	100	100	100

The above had remained for a long time in pasture, and the second was remarkable for the fattening qualities of its grass when fed to cattle.

The following are arable lands of great fertility :

	1	2		3
	Soil from Moravia.	From Ohio. Soil.	Subsoil.	Soil From Belgium.
Silica and fine Sand	77·209	87·143	94·261	64·517
Alumina . .	8·514	5·666	1·376	4·810
Oxides of Iron .	6·592	2·220	2·336	8·316
Oxide of Manganese	1·520	0·360	1·200	0·800
Lime . .	0·927	0.564	0·243	Carb. of Lime. 9·403
Magnesia . .	1·160	0·312	0·310	Carb. of Mag. 10·361
Potash chiefly combined with Silica	0·140	0·120	0·240	0·100
Soda, ditto . .	0·640	0·025		0.013
Phosphoric Acid combined with Lime and Oxide of Iron,	0·651	0·060	trace	1·221
Sulphuric Acid in gypsum . .	0·011	0·027	0·034	0.009
Chlorine in common salt . .	0·010	0·036	trace	0·003
Carbonic Acid united to the Lime .	——	0·080	——	——
Humic Acid .	0·978	1·304	——	0·447
Insoluble Humus	0·540	1·072	——	——
Organic substances containing nitrogen	1·108	1·011	——	——
	100	100	100	100

"Of these soils, the first had been cropped for 160 years successively, without either manure or naked fallow. The

second was a virgin soil, celebrated for its fertility. The third had been unmanured for twelve years, during the last nine of which it had been cropped with beans, barley potatoes, winter barley and red clover, clover, winter barley, wheat, oats, naked fallow."—(*Johnston.*)

Bergman found, that one of the most fertile soils in Sweden contained 30 per cent. of carbonate of lime. Chaptal analyzed a very productive soil in France, which gave near 25 per cent of the same, and 7 of organic matter. Tillet even found one, and that the most fertile, which yielded 37.5 of carbonate of lime. Some of the best in the Mississippi valley, have yielded upon analysis, 20 to 25 per cent. of magnesian lime, and of phosphate of lime, 2 to 3 per cent. Many other soils throughout the United States, contain an equal proportion of carbonate of lime. Such are always the last to wear out, and the first to recover by the addition of manures, when suffered to remain uncultivated or in a state of rest.

CHAPTER II.

MANURES.

While soils are permitted to remain in their natural state, or if denuded of their original foliage and used only for pasture, little or no change is perceptible either in their character or productive powers. A slight change is however gradually wrought in their texture and capacity for production, which is fully revealed in the lapse of centuries. The elevated mountain's side, and the steep declivities of hills, support a vegetation of more or less luxuriance ; and a portion of this, together with the broken twigs, and even the wasting matter of fallen trees, are carried down by the rains and become a rich addition to the lower soils on which they ultimately rest. Besides the vegetable matter thus annually removed from one spot and accumulated upon another, many of the fertilizing salts, which the action of the roots, or exposure to the atmosphere has rendered soluble, and the fine particles of earth which the alternations of heat and frost, of rain and drought have reduced to dust, are also washed out of the higher soils and deposited on the plains and vallies below. Such, doubtless, was once the condition of those secondary bottom-lands, which for ages probably, received the rich deposits from other soils, but whose present situations, elevated beyond even the extraordinary rise of the rivers whose course is near, show some radical alteration of their respective levels, by which the latter no longer contributes to their fertilization.

These soils being well stored with the food of plants, and frequently to a great depth, will bear large successive crops for a long period ; and they have, in many instances, been treated by their first occupants as if they were inexhaustible. Of this description were the James river and other alluvial lands in Virginia, some of which were continued in uninterrupted crops of corn and tobacco for more than a century without the addition of manures. But they have long since become exhausted, and the more careful planters are now endeavoring to resuscitate those worn-out lands, which ought never to

have become impoverished. Of the same character are most of the secondary bottoms on the Connecticut, the Scioto, the Miami, and other rivers. The first, although under cultivation for more than two centuries, in consequence of its division among intelligent farmers, has fully maintained its productiveness; and the latter, if properly managed, are capable of perpetual fertility. Although but a little more than half a century has elapsed since these last have been subject to the white man, they have already, in too many instances, been severely cropped. The writer has seen fields, which he was assured have born forty-seven large successive crops of corn, and exclusively from their own resources. A more careful tillage is however becoming general.

The lower alluvial bottoms that are frequently overflowed, and thus receive large coatings of manures which are fully equivalent to the products taken off, are the only soils which will permanently sustain heavy crops without the aid of man. Such are the banks of the Nile and the Ganges, and many of our own rivers, which by the overflowing of their waters alone, have continued to yield large annual burthens, the two former, for more than 3000 years; but they are thus supported at the expense of a natural drainage of thousands of acres, which by this means, are proportionally impoverished. Manures then in some form, must be considered as absolutely essential to sustaining soils subjected to tillage.

In their broadest sense, manures embrace every material, which if added to the soil, tends to its fertilization. They are appropriately divided into *organic aud inorganic;* the first embracing animal and vegetable substances, which have an appreciable quantity of nitrogen; the last comprehending only such as are purely mineral or earthy, and which in general contain no nitrogen. These characteristics are sometimes partially blended, but they are sufficiently distinct for classification.

Much pertinacity has been exhibited by some highly intelligent minds, who should have entertained more liberal views, as to the peculiar kinds of manures necessary to support a satisfactory productiveness. We have seen that Tull maintained, that the deepening and thorough pulverization of the soil was alone sufficient to secure perpetual fertility. But this crude notion, it is evident to the most superficial modern reader, is wholly untenable. Some agriculturists of the present day however, while they scout at the theory of Tull, (who was really a shrewd man for his day,) will yet

claim as essential to successful vegetation, the existence in the soil of but a part only of the food of plants. Thus, one asserts that the salts alone will secure good crops; others maintain that the nitrogenous substances are the true source of fertility; while still another class refer to the presence of humus or geine (the available product of vegetable and animal decay in the soil) as the only valuable foundation of vegetable nutriment in all manures. Truth and sound practice lie between, or rather in the combination of all these opinions.

It has been shown in a preceding page, that all fertile soils must have not less than 15, and more probably 16 different simple or elementary substances, in various combinations with each other. All of the ordinary cultivated plants contain potash, soda, lime, magnesia, alumina, silica, oxide of iron, oxide of manganese, sulphuric acid, phosphoric acid, chlorine, and frequently iodine; each of which, excepting the two last, are in combination with oxygen. In addition to these, they also have carbon, oxygen, nitrogen and hydrogen. Other substances or ultimate principles may possibly exist in plants, which analysis may hereafter detect, but hitherto they have eluded the closest investigation.

It is therefore obvious that such principles as all fertile soils furnish to vegetables, must be contained in manures. It is no satisfactory answer to this position to assert, that numerous experiments have apparently been successful, of growing plants in pure sand and water; or with charcoal and the salts added; or even that there are some atmospheric plants, that fulfil their zoophytic existence in air. Growth may continue for a long time under such circumstances; *but full maturity never arrives, and probably never can, without the available presence in the soil of every element which enters into the composition of plants.*

Profitable farming requires that manures embodying all these elements, should be added in sufficient quantities to the soil, to develope fully and rapidly, such crops as are sought from it. It becomes then, a matter of the highest consequence to the farmer to understand, not only what substances may be useful as manures; but also how to apply them in the best manner to his crops so far as they can be made profitable. We shall first speak of the inorganic manures.

ASHES.

If any organic matter, whether animal or vegetable, be burnt, an incombustible substance remains behind, called the

ash or ashes. This varies in different plants from less than 1 to over 12 per cent. of their whole weight. It also varies with the different soils upon which they are found, with the different parts of the same plant, and in the different stages of its maturity. Thus plants which grow on peaty or low, wet soils, give a less proportion of ashes, than those which mature upon soils that are dry or rich in the silicates and salts. The bark, leaves and twigs, give much more ashes than the trunks of trees and stems of plants: and in their early growth, they yield a larger proportion, than after they have attained maturity.

The following table, constructed from several reliable sources, but principally by Sprengel, arranged in part by Johnston, will shew the relative quantity of ashes found in some of the more important objects of cultivation :

	Potash.	Soda.	Lime.	Magnesia.	Alumina.	Silica.	Sulphuric Acid.	Phosphoric Acid.	Chlorine.	Oxide of Iron.	Oxide of Manganese.	Total in every 1000 lbs.
Wheat—Gr'n	2.25	2.40	0.96	0.90	0.26	4.00	0.50	0.40	0.10	trace		11.77
" St'w	0.20	0.29	2.40	0.32	0.90	28.70	0.37	1.70	0.30			35.18
Barley—Gr'n	2.78	2.90	1.06	1.80	0.25	11.82	.59	2.10	0.19	trace		23.49
" St'w	1.80	0.48	5.54	0.76	1.46	38.56	1.18	1.60	0.70	0.14	0.20	52.42
Oats — Grain	1.50	1.32	0.86	0.67	0.14	19.76	0.35	0.70	0.10	0.40		25.80
" Straw	8.70	0.02	1,52	0.22	0.06	45.88	0.79	0.12	0.05	0.02	0.02	57.40
Rye — Grain	5.32	*	1.22	0.44	0.24	1.64	0.23	0.46	0.09	0.42	0.34	10.40
" Straw	0.32	0.11	1.78	0.12	0.25	22.97	1.70	0.51	0.17			27.93
Field Bean — Bean	4.15	8.16	1.65	1.58	0.34	1.26	0.89	2.92	0.41			21.36
Field Bean — Straw	16.56	0.50	6.24	2.09	0.10	2.20	0.31	2.26	0.80	0.07	0.05	31.21
Field Pea — Pea	8.10	7.39	0.58	1.36	0.20	4.10	0.53	1.90	0.38	0.10		24.64
Field Pea — Straw	2.35		27.30	3.42	0.60	9.96	3.37	2.40	0.04	0.20	0.07	49.71
Potatoes — Roots	4.028	2.334	.331	.324	.050	.084	.540	.401	.160	.032		8.284
Potatoes — Tops	8.19	.09	12.97	1.70	.04	4.94	.42	1.97	.50	.02		30.84
Turneps — Roots	2.386	1.048	.752	.254	.036	.388	.801	.367	.239	.032		6.303
Turneps — Leav's	3.23	2.22	6.20	.59	.03	1.28	2.52	.98	.87	.17		18.09
Carrots	3.533	.922	.657	.384	.039	.137	.270	.514	.070	.033	.060	6.619
Parsneps	2.079	.702	.468	.270	.024	.162	.192	.100	.178	.005	?	4.180
Rye Grass	8.81	3.94	7.34	0.90	0.31	27.72	3.53	0.25	0.06			52.86
Red Clover	19.95	5.29	27.80	3.33	0.14	3.61	4.47	6.57	3.62			74.78
White Clover	31.05	5.79	23.48	3.05	1.90	14.73	3.53	5.05	2.11	0.63		91.32
Lucern	13.40	6.15	48.31	3.48	0.30	3.30	4.04	13.07	3.18	0.30		95.53
Sainfoin	20.57	4.37	21.95	2.88	0.66	5.00	3.41	9.16	1.57			69.57

* Included in Potash.

In the foregoing table, the grain, beans, peas, straw and hay are estimated after they have been dried in the air; the roots as they are taken from the field. The clovers and grass lose from 55 to 75 per cent of their entire weight when full of sap, lessening, of course, as they approach to the state of ripening their seed. The potato loses in drying, 69 per cent of water; the turnip, 91; carrot, 87; the turnip leaf, 86; the carrot leaf, parsnep and parsnep leaf, each 81; and the cabbage, 93.

There is much variation in the different specimens of the above substances subjected to examination. according to the peculiar variety, the different circumstances and various stages of their growth. The oat is the most variable of the grains, one specimen sometimes containing three times the quantity of ash afforded by others. The roots also sometimes vary as three to one in their quantity of ash. As the grain and most of the other crops approach to maturity, the quantity of some of the principles constituting the ash diminish, as of potash and soda, their presence being no longer necessary in the sap to aid the formation of the various products of the plants.

The farmer will perceive from this table, the great value of ashes to his crops. The quantity seems small in comparison with the total weight of the vegetable ; yet small as it is, the aggregate of a few years will so far exhaust the soil of one or more of the principles necessary to sustain a luxuriant vegetation, that it will cease to yield remunerating returns. The annual exhaustion of salts from large crops of grain, roots and grass, is from 180 to more than 250 lbs. in every acre of soil. The ashes of vegetables consist of such elements as are always required for their perfect maturity, and it is evident they must furnish one of the best manures which can be supplied for their growth. They are to the earthy parts of vegetables, what milk is to the animal system, or barn-yard manures are to the entire crop ; they contain every element, and generally in the right proportions, for insuring a full and rapid growth.

Ashes then, may be pronounced the best of the saline manures. They are also among the most economical ; as from our free use of fuel, they are largely produced by almost every household. Good husbandry dictates that not a pound of ashes should be wasted, but all should be saved and applied to the land ; and where they can be procured at a reasonable price, they should be purchased for manure. Leached ashes, though less valuable, contain all the elements of the unleached, having been deprived only of a part of their potash and soda. They may be drilled into the soil with roots and grain, sown broadcast on meadows or pastures, or mixed with the muck-heap. They improve all soils not already saturated with the principles which they contain.

The quantity of ashes that should be applied to the acre, must depend on the soil and crops cultivated. Potatoes, turnips and all roots—clover, lucern, peas, beans, and the grasses are great exhausters of the salts, and they are consequently much benefitted by ashes. They are used with decided advantage for the above crops in connexion with bone-dust ; and for clover, peas and roots, their effects are much enhanced when mixed with gypsum. Light soils should have a smaller, and rich lands or clays, a heavier dressing. From 12 to 15 bushels per acre for the former, and 30 for the latter, is not too much ; or if they are leached, the quantity may be increased one-half, as they act with less energy. Repeated dressings of ashes, like those of lime and gypsum, without a corresponding addition of vegetable or barn-yard manures, will eventually exhaust tillage lands.

Ashes may be applied to meadow-lands, for a longer time than to any other crops, and for this obvious reason. The whole surface of the soil is closely covered with vegetable agents, which are actively employed in drawing carbon from the air and soil, a large portion of which is stored up in the stubble and roots, which thus makes it less important that the organic matters should be given back to the soil, in the shape of vegetable or animal manures. As an instance of the rapidity with which this operation goes forward, it has been found that the dried roots and stubble of a clover-field the second year, (and after one crop for the first, and two for the second season had been taken off,) yielded 56 lbs. for every 100 lbs. of the aggregate crops of hay. An old meadow has yielded 400 lbs. of roots for every 100 of hay for the season. Carbonaceous and organic matters are constantly increasing in pastures, and they also increase for a time in meadows; and will continue to do so for an indefinite period, if the ashes of plants are added to the soil nearly to the amount of those taken off. With this increase in the organic elements of vegetation, (if we were certain that nitrogen is accumulated in the same ratio, which we are not,) it is evident that the salts alone would then be wanting to give the utmost luxuriance. But care is necessary that they be not added in excess.

Coal-Ashes.—The bituminous and anthracite coals afford ashes, and although inferior in quality to those made from wood and vegetables, are like them, a valuable manure and they should be applied to the land in a similar manner. If they contain many cinders from not having been thoroughly burned, they are more suited to heavy than to light soils; as they tend to their mechanical division, which though beneficial to the former, are injurious to the latter.

Ashes of Sea-Weeds or Marine Plants.—When from their quantity or remoteness it is inconvenient to carry the sea-weed, which abounds on some coasts on to the soil, it can be burned; when it will be found to yield a large proportion of ash, which is peculiarly rich in soda. This is of great value to the farmer. Several species of the *fuci* have for a long period been collected and burned on the northern coasts of Scotland, Norway and the Baltic, forming an article of commerce under the name of *kelp*. Its value consisted in its alkaline properties, for which it was much used by the glass and soap-makers, the bleachers, and for other uses in the arts. For these purposes it is now nearly superseded by *soda ash*, a crude carbonate of soda, extracted by the

decomposition of sea-salt; and the price it now bears in market will bring it within the reach of farmers for some of the economical purposes of husbandry.

Peat Ashes — Nearly all peat approaching to purity, when thrown out of its bed and thoroughly dried, will admit of being burned to an imperfect ash; and when it does not reach this point it will become thoroughly charred and reduced to cinders. In both of these forms, it is a valuable dressing for the soil. It is always better for dry uplands to use the unburned peat after it has been properly composted in a muck heap, as the organic matters which it contains and which are expelled by burning, are of great benefit to the soil. But when they are remote, the peat may be burned at a trifling cost, and the ashes carried to a considerable distance with manifest profit. The principal use hitherto made of them by farmers, has been in spreading them directly over the surface of the reclaimed bed from which they were taken.

LIME.

Lime is the product of limestone, marble, marl or chalk after it has been burned, or subjected to an intense heat. In either of the foregoing forms it is a carbonate, and contains from 43 to 46 per cent of its weight of carbonic acid, which is expelled by calcination. After the acid has been driven off it exists in its quick or caustic state, and in that condition its affinity for moisture and carbon is so great that it greedily combines with both on exposure to water, the earth, or even to the atmosphere; passing again into a carbonate and hydrate. It is in these latter conditions that it is applied to soils and muck heaps. If reduced to powder (the condition in which chalks and marls exist,) limestone would act with equal efficiency as if burnt.

Lime next to ashes, either as a carbonate or sulphate, has been instrumental in the improvement of our soils beyond any other saline manures. Like ashes too, its application is beneficial to every soil, not already sufficiently charged with it. It makes heavy land lighter, and light land heavier; it gives adhesiveness to creeping sands or leachy gravel, and comparative openness and porosity to tenacious clays; and it has a permanently beneficial effect where generally used, in disinfecting the atmosphere of any noxious vapors existing in it. It not only condenses and retains the organic matters brought into contact with it by the air and rains, but it has the farther effect of converting the insoluble matters in the

soil, into available food for plants. It has proved in many instances the wand of Midas, changing everything it touched into gold. It is the key to the strong box of the farmer, securely locking up his treasure till demanded for his own use, and yielding it profusely to his demands whenever required. In its influence in drying the land, and accelerating the growth of plants, the use of lime is equivalent to an increase of temperature; and the farmer somtimes experiences, in effect, the same benefit from it, as if his land were removed a degree or two to the south. The influence of lime in resuscitating soils after they have been exhausted, has been frequent and striking; and it may be stated as an incontrovertible truth, that wherever procurable at low prices, lime is one of the most economical and efficient agents in securing fertility within the farmer's reach.

It has been falsely said to be an exhauster of soils; that it enriches the fathers and impoverishes the sons. So far as it gives the occupant of the land the control over its latent fertility, this is true, but if he squanders the rich products when within his reach, it will be his own fault. Lime gives him the power of exhausting his principal; if he uses aught beyond the interest, his prodigality is chargable to his own folly, not to the liberality of his agent. By the addition of lime to the soil, the insoluble ingredients contained in it are set free, and they are thus enabled to aid in the formation of plants, and larger crops and of better quality are the results. If these be taken from the soil, without a corresponding return of manure, exhaustion must follow. In the preceeding table it is seen, that lime constitutes in all cases, only a very minute part of the entire plant; all the other ingredients must be added or the fertility of the soil cannot be sustained. But in the very abundance of the crops which lime affords, means are provided for the maintainance of the highest fertility. If they are consumed on the farm their manure should be returned to the fields; and if sold, other manures should be procured to replace the substances from which they are formed.

A practice which has extensively prevailed for many years in sections of the eastern states, consists in alternating wheat and clover on strongly limed lands. The plan usually adopted is to give one year to wheat and two to clover, sometimes taking off the first clover crop for hay, and feeding off on the ground and plowing in the after growth for manure; and upon this, wheat is again sown. This course has succeeded in bringing into fine condition, many unprofitable fields. It

may work well for years, but it is nevertheless faulty and improvident. Lime only is added directly to the soil, but clover draws from the air and moisture whatever food it can attract from them. There remain to be added potash, soda, the phosphates and silicates, which the soil will soon cease to furnish sufficient for the wants of the wheat and clover removed, or stertility must inevitably follow.

The best method, *is to add in some form, the full amount of all the materials, abstracted by the annual crop.* When this is done, the large dressing of lime will retain the accumulating fertility, far beyond what the soil would be capable of were it not for its agency; and it is in this that the great profit of farming consists.

Large crops only are profitable. The market value of many indifferent ones will hardly meet the expense of cultivation, and it is only the excess beyond this which is profit. It is evident that if 15 bushels per acre of wheat, be an average crop, and it requires 12 bushels to pay all expenses of production, 3 bushels is the amount of profit. But if by the use of lime and ordinary manures, the product can be raised to 30 bushels per acre, the profit would be near the value of 12 or 15 bushels, after paying for the manures. Thus the advantage from good management may be five times that of neglect. This example is given as illustrating a principle and not as an exact measure of the difference between limed and unlimed land.

Application of lime.—It may be carried on to the ground immediately after burning and placed in small heaps. There it may be left to slack by rains and the air, or it is better to reduce it at once with water if accessible, and then spread it preparatory to plowing. A good practice is to place it in large piles and cover it thickly with earth, which gradually reduces it to powder. It may then be carried where it is wanted and spread from the cart. It is still better, when small quantities only are wanted to add it to the compost after it has been thoroughly air-slacked, avoiding fermentation as far as practicable after it has been added, as its avidity for carbon expels the ammonia, which is the most valuable of the volatile ingredients of the muck heap. A thick coating of earth over the whole, will arrest and retain much of the gas that would otherwise escape.

Fresh burnt lime does not act on the crops during the first year, and it may be prepared for action as well by mixing it

with 3 or 4 times its bulk of earth, as by spreading it directly upon the ground.

Magnesian Lime.—Many of the limestones contain magnesia and are called magnesian lime. The effect of this is a more energetic action and where it is found in lime, the same result will be produced by the application of a less quantity. Oyster and all other shells of marine origin, afford pure lime by burning.

The amount to be used depends entirely on the soil. Somc fertile lands contain over 30 per cent. in their natural state. 800 bushels of lime per acre, have been applied at one time to heavy clays and such soils as were full of vegetable mold, with decided benefit to the land. In the United States, the average for a first dressing, is from 50 to 120 bushels per acre; which may be renewed every 4 or 6 years, at the rate of 20 to 40 bushels. If an overdose has been applied, time or the addition of putrescent or green manures are the only correctives.

To give lime its fullest effect, it should be kept as near the surface as possible; and for this reason it is well to spread it after plowing, taking care to harrow it well in. Allow it then to remain in grass as long as possible. Its weight and minuteness give it a tendency to sink and after a few years cultivation, a large proportion of it will be found to have got beyond the depth of its most efficient action. This circumstance gives additional value to the system of underdraining and subsoil plowing, which enables the atmosphere and root to follow it, thus prolonging its effect and greatly augmenting the benefit to crops. It should be spread upon the ground immediately after taking off the last crop, so as to allow all the time possible for its action before the next planting

Application to Meadows.—In addition to its other good effects, lime like ashes, is useful to meadows in destroying the mosses and decomposing the accumulated vegetable decay on the surface. For this purpose it may be spread on them unmixed, after having first passed into the state of carbonate or effete lime, to prevent injury to the grass. If no such necessity require its use in this form, it may be combined advantageously with the muck and scattered broadcast over the meadow.

MARLS.

Marls are composed of carbonate of lime, mixed with clay, sand, or loam, and frequently with sulphate and phosphate

of lime. They are a useful application to land in consequence of the lime they yield, and when containing the phosphate in addition, their value is largely increased. The quantity that may be advantageously used is even more variable than that of pure lime, inasmuch as the quality varies with every bed in which it is found. They are adapted to the improvement of all soils, unless such as are already sufficiently filled with lime, and they are more generally useful to meadows than the pure carbonate. Their benefits will be greatly enhanced if the clay marl be used on light or sandy soils, and sandy marls on clay and heavy lands. From 20 to 400 cart loads of marl per acre have been applied according to its quality and the character of the land to be benefitted. Circumstances must alone determine the proper quantity to be used.* Marl should be carried out and exposed in small heaps before spreading on the land. Exposure to the sun and especially to the frosts of winter, is necessary to prepare it for use.

SHELL SAND.

This is a calcareous sand, sometimes mixed with animal matter. It abounds on some parts of the coast of Cornwall, and on the western shores of Scotland, and Ireland. It is also found on the coast of France, and particularly in Brittany where it is known by the name of *trez*. This produces prodigious effects on peaty, clay and other soils, to which it is applied at the rate of 10 to 15 tons per acre. It is so much esteemed for the former, that it is sometfines carried to a distance of 100 miles. It is probable there are similar deposites on the coast of some of the Atlantic States, though we are not aware of any such application for agricultural objects. Its great value as a top dressing, will fully justify exploration, for the purpose of detecting it wherever it may exist.

*Marls may be readily analyzed by any one with a pair of accurate scales and weights, and a large mouthed vial. To one part muriatic acid, add 2 parts water and fill the vial to about one third, and balance it on the scales. Then slowly add 100 grains of the pulverized marl, thoroughly dried over the fire. When the effervescence has subsided, expel the carbonic acid from the vial, by pouring it off, blowing into the vial through a reed or with a bellows, its greater weight causing it to retain its place to the exclnsion of the air. Now add weights to the opposite scale till balanced, and the deficiency of grains under 100, will show the amount of carbonic acid expelled; and as this is combined in the proportion of 46 to 54 of quick or pure lime, in every 100, the loss indicates 46 per cent of the carbonate of lime contained in the marl.

From the frequent presence of phosphate and sulphate of lime, and sometimes potash and animalized matters in marls, this kind of analysis seldom indicates the value of a marl bed for agricultural purposes. If its exact worth is to be ascertained, there must be a more perfect analysis by an experienced chemist.

GREEN SAND MARL.

There are extensive beds of a green sand (generally though improperly termed) marl, which run through a section of New-Jersey, from which farmers have derived an astonishing addition to their crops. It is found by analysis to contain but a small quantity of lime, but it readily yields a large amount of potash, varying from 6 to 15 per cent. From a careful analysis of eight different specimens, Prof. Rodgers found in it an average of 10 per cent. of potassa. The effect of this applied to the barren sands which abound in that neighborhood, has been so favorable, that lands which before could be bought for $3 per acre, would afterwards bring $40. Several deposits of green sand in the counties of Plymouth and Barnstable, Mass., similar in external appearance to the foregoing, were explored by Prof. Hitchcock, and specimens were analyzed by Dr. Dana, without however, detecting any qualities of decided advantage to agriculture.

GYPSUM—PLASTER OF PARIS—OR SULPHATE OF LIME.

This is a combination of lime with sulphuric acid and water in the proportion of 28 of lime, 40 of acid, and 18 of water. It is frequently found in connexion with carbonate of lime, clay &c. The use of gypsum has been attended with great benefit in most parts of the United States; and by many of the most experienced farmers, is justly considered as indispensable to good farming. Like all saline, and indeed all other manures, it acts beneficially only on soils which are free from standing water, or which may be saturated with it. It is felt most on sandy, loamy, and generally on clay soils, requiring more for the latter, and for all such as contain a large proportion of vegetable matter. From two pecks on sandy, to fifteen bushels on clay soil have been applied per acre; but from two to four bushels is the usual quantity.

The crops on which it produces the greatest effect are the red and white clover, lucern and sainfoin, and the leguminous plants, peas, beans, &c. On natural meadows and the cereal grains, it has no perceptible influence.

It should be sown broadcast as soon as the leaves have expanded in the spring. It takes 460 times its weight of water to dissolve it, which shows the necessity of applying it while the early rains are abundant, and the increased effect

of sowing it on the leaves, requires that its application should be deferred till they have become partially developed. For corn, potatoes, turneps, &c., it is usually put in with the seed, or sprinkled upon them after the first hoeing.

From its great effect on the clovers, increasing them sometimes to twice, and in rare instances, to thrice the qantity produced without it, it is manifest that it is the most profitable manure which can be used, as it can be generally procured by farmers at from $3 to $6 per ton. Yet it should be fully understood, that like lime and ashes, it furnishes only a part of the food of plants; and like them too, the addition of vegetable and animal manures is indispensable to secure permanent fertility.

Extensive sections of this and other countries, particularly in Great Britain, apparently derive no benefit from the application of gypsum. This failure has been variously ascribed to there being already enough in the soil; or to the presence of a marine atmosphere. Its great usefulness however, on many parts of our Atlantic coast, would seem to require some other explanation than the last as the cause of its inefficiency. Experiment alone can determine the circumstances which will justify its application, and to this test should not only this, but all other practices of the farmer be rigidly subjected.

BONES.

About 33 per cent. of fresh bone, consists of animal matter, (oil, gelatine, &c;) from 53 to 56 per cent. of phosphate of lime and the remainder is principally carbonate of lime, soda and magnesia. There is no part of the bone that is not useful to vegetation; it is especially so to the various kinds of grain, to potatoes, turneps, the clovers, peas and beans. The bones should be crushed or ground, and then drilled in with the seed, or scattered broadcast, at the rate of 25 bushels per acre. They may be repeated in less quantities every 4 or 5 years, or till the soil ceases to be improved by them, when they should be withheld till additional cropping shall have so far exhausted them as to justify a further supply.

Bones are generally boiled before using for manure to extract the oil and glue. This does not lessen their value for agricultural purposes, beyond the diminution of their weight, while it hastens their action. They are sometimes burned, which drives off all the organic matter, leaving only

the lime, &c., to benefit the soil. This is a wasteful practice, though the effect is more immediate on the crops; but it is also more transient, and they require to be more frequently renewed. Bones ought always to be saved; and if not practicable to crush them, they may be thrown upon the land, where they will gradually corrode and impart their fertilizing properties. When partially decomposed and buried just beneath the surface, the roots of the luxuriant plants above, will twine around them in all directions to suck out the rich food which ministers so freely to their growth. Crushed bones are advantageously used with nearly an equal amount of ashes, or with one third their weight of gypsum; or, as with nearly all other saline manures, they may be added to the muck heap.

PHOSPHATE OF LIME.

This exists in a fossil state, and is known in some of its forms as *apatite*, *phosphorite*, &c. An extensive quarry is found in Estramadura, in Spain, and smaller deposites of it have been discovered in different parts of the United States, under a variety of names. It is probable it may yet be found in such localities and in such quantity as to be useful to the farmer. It has been shown that more than half of the whole weight of bones consists of pure phosphate of lime; its value therefore is apparent.

SALT — OR CHLORIDE OF SODIUM

Is variously obtained, as fossil or rock salt; from boiling or evaporation of salt springs; and from the waters of the ocean. In a pure state it consists of 60 of chlorine and 40 of sodium, in every 100 parts. Sodium chemically combined with oxygen forms soda; and it will be seen by referring to the table, page 32, that salt furnishes two of the important constituents in the ash of every vegetable. Its advantage to vegetation are to be inferred from a knowledge of its composition, which is fully sustained by experience. As a manure, salt was extensively used by the ancients, and has ever since been employed by intelligent agriculturists. On some soils it yields no apparent benefit. Such as are near the sea-coast and occasionally receive deposites from the salt spray, which is often carried far inland by the ocean storms; or such as contain chlorine and soda in any other forms, are not affected by it. But in other situations, when used at the rate of 3 to 16 bushels per acre, the crops of grains, roots or grasses have

been increased from 20 to 50 per cent. It may be applied in minute portions in the hill, or scattered broadcast, or mixed with the muck heap. Its great affinity for water has the effect, like that of gypsum, of attracting dews and atmospheric vapor to the growing vegetation, by which it is supplied with moisture in a period of drought much beyond what is conveyed to such as are destitute of these manures. Salt is also useful in destroying slugs, worms, and larvæ which frequently do much injury to the crops.

SULPHATE OF SODA, (*Glauber Salts*,) SULPHATE OF MAGNESIA, (*Epsom Salts*,) AND SULPHATE OF POTASH.

These are all useful manures, and they act on vegetation in a manner similar to gypsum. This was to have been expected so far as the sulphuric acid is concerned, which is common to each; but their action is modified to a certain degree by the influence of the base or alkaline ingredients on the plants. The generally increased price which they bear over gypsum, will prevent their use away from those localities, where they exist in a state of nature, or where they may be procured at low rates, near the laboratories in which they are manufactured.

NITRATE OF POTASH, (*Saltpetre*,) AND NITRATE OF SODA.

These are both found in a crude state in native beds, or as an efflorescence; and in this condition they can frequently be bought at a price which will justify their use. The first contains potash 46½, and nitric acid 53½; the second, in its dry state, soda 36½, and nitric acid 63½, in every 100 parts. Numerous experiments have been tried with them on various crops; but they have not thus far, afforded very accurate or satisfactory results. In general, they give a darker color and more rapid growth, and they increase the weight of clover, grass and the straw of grain; and the former are more relished by cattle. But in the average effects upon grain and roots, the statements are too much at variance to deduce any well settled principles.*

As a soak or steep for seeds, and especially when dissolved and added to the bed where they are planted, there is no doubt of their great value in giving an early and vi-

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* From the decidedly beneficial effects, produced in numerous instances, may we not reasonably infer, that they have generally been successful, where there has been a deficiency of them in the soil?

gorous start to vegetables. This enables them rapidly to push forward their roots, stems and leaves, thus obtaining a greater range for the roots and more mouths for the leaves to draw their nourishment from the atmosphere.

CARBONATES, NITRATES, SULPHATES, PHOSPHATES, SILICATES, AND CHLORIDES.

Several of these have just been particularly enumerated. The remainder are composed of carbonic, nitric, sulphuric and phosphoric acids, silica and chlorine, in chemical combination with potash, soda, lime and the other bases of plants. Although no one of these can fail to benefit crops, when rightly applied, yet the expense of most of them will prevent their extended use. This can only be looked for from those which are procurable at a cheap rate. The chemical laboratories, glass works and some other manufactories, afford in their refuse materials, more or less of these mineral manures, which would well repay the farmer for removing and applying to his land. The most obvious that occur in this country, are all that will be here mentioned.

OLD PLASTER.

This is a true silicate of lime, being formed mostly of siliceous sand and lime, chemically combined. For meadows, and for most other crops, especially on clays and loams, this is worth twice its weight in hay; as it will produce a large growth of grass for years in succession, without other manure. This effect is due not only to the lime and sand, but to the nitric acid which they have abstracted from the atmosphere, and which they continue alternately (while in combination) to absorb from the air and give out to the growing plant. But the farmer cannot too carefully remember, that with this, as with all other saline manures, but a part of the ingredients only is thus supplied to vegetables; and without the addition of the others, the soil will sooner or later become exhausted.

BROKEN BRICK AND BURNT CLAY.

These are composed mostly of silicate of alumina, generally mixed with silicate of potash and other substances. They are of much value as a top-dressing for meadows. In addition to their furnishing in themselves a minute quantity of the food of plants, like old plaster, they serve a much more ex-

tended purpose, by condensing ammonia nitric acid and the gases of the atmosphere.

CHARCOAL,

Scattered over the ground, produces the same effect as the foregoing, and probably in a greater degree ; as it absorbs and condenses the nutritive gases within its pores, to the amount of from 20 to over 80 times its own bulk. The economy and benefit of such applications can be readily understood, as they are continually gleaning these floating materials from the air, and storing them up as food for plants. Charcoal as well as lime, often checks rust in wheat, and mildew in other crops ; and in all cases mitigates their ravages, where it does not wholly prevent them.

BROKEN GLASS

Is a silicate of potash or soda, according as either of these alkalies are used, in its manufactures. Silicate of potash, (silex and potash chemically united,) is that material in plants, which constitutes the flinty, outer coating of the grasses, straw, cornstalks, &c. ; and it is found in varying quantity in all plants. It is most abundant in the cane, Indian corn, the stings of nettles, and the prickly spikes in burs and thistles. Some species of the marsh-grasses have these silicates so finely yet firmly adjusted, like saw-teeth on their sharp edges, as to cut the flesh to the bone when drawn across the finger. Every farmer's boy has experienced a yet more formidable weapon in the exterior of a cornstalk.

It is to the absence of this material in peat and such other soils as have an undue proportion of animal or vegetable manures, that we may attribute the imperfect maturity of the grain and cultivated grasses grown upon them, causing them to crinkle and fall from the want of adequate support to the stem ; and it is to their presence in excess in sandy and calcareous soils, that the straw is always firm and upright, whatever may be the weight of the bending ear at the top. By a deficiency of silicates, we mean, that they do not exist in a soluble form, which is the only state in which plants can seize upon and appropriate them. The efforts of the roots in procuring this indispensable food are so irresistible, that they have been known to decompose glass vessels in which they have been grown. Before using, the glass should be reduced to powder by grinding.

CRUSHED MICA, FELDSPAR, LAVA, THE TRAP ROCKS, &c.

Feldspar contains 66.75 of silica; 17.50 alumina; 12 potash; 1.25 lime; and 0.75 oxide of iron. *Mica* consists of silica, 46.22; alumina, 34.52; peroxide of iron, 6.04; potash, 8.22; magnesia and manganese, 2.11. Most of the *lavas* and *trap-rocks* hold large quantities of potash, lime, and other fertilizing ingredients. The last frequently form the entire soils in volcanic countries, as in Sicily, and around Mount Vesuvius in Italy, in the Azores and Sandwich Islands; and their value for grains and all cultivated plants is seen in the luxuriance of their crops and the durability of their soils. These examples illustrate the great influence of saline manures, and their near approach to an entire independence in sustaining vegetation. Whenever they become exhausted by the severe usage they undergo, two or three years of rest enables them again to yield a remunerating crop to the improvident husbandman. *Granite, sienite, and some other rocks*, yielding large proportions of potash and some lime, abound throughout the eastern portion of this country. The potash in them is however firmly held in an insoluble state; but if it be subjected to a strong heat, it may afterwards be crushed, and then yield it in an easily soluble form, and constitute a valuable top-dressing for lands.

It is a subject of frequent remark, that the soil underneath, or in immediate contact with some stone walls, which have been erected for a long period, is much richer than the adjoining parts of the same fields. This difference is probably due, in some measure to the slow decomposition of important fertilisers in the stone, which are washed down by the rains and become incorporated in the soil. The removal of stones from a fertile field, has been deprecated by many an observing farmer, as materially impairing its productiveness. Beyond the shade thus afforded against an intense sun, protection from cold winds, their influence in condensing moisture, (and the beneficial effects which perhaps ensue as in *fibrous covering*,) the difference may be attributable to the same cause.

SPENT LYE OF THE ASHERIES

Is the liquid which remains after the combination of the lye and grease in manufacturing soap. It is of great value for plants. Before its application to the land it should be mixed with peat or turf, or diluted with ten times its bulk of water. Five gallons of this lye is estimated to contain as

much potash or soda, according as either is used, as would be furnished by three barrels of ashes. It has besides, a large quantity of nitrogen, the most valuable ingredient of animal manure, which by judicious application, is either converted into ammonia, or serves the same purpose in yielding nutrition to plants.

AMMONIACAL LIQUOR (*from the gas-houses*).

This liquid is the residuum of bituminous coal and tar used in making gas, and holds large quantities of nitrogen, from which ammonia is frequently extracted. When used for land near by, it may be carried to the muck-heap in barrels ; and when at remote distances, gypsum or charcoal dust may be added to the barrel, stirring it well for some time, and then closely covering it. The gypsum and charcoal soon combine with the ammonia, when the liquid may be drawn off, and the solid contents removed. It is a powerful manure, and should be sparingly used.

GUANO

Is derived exclusively from the animal creation, but from its existence in a highly condensed state, and in combination with large proportions of the salts, and having by its accumulation through thousands of years lost the distinguishing characteristics of recent animal matter, it may almost be considered as a fossil, and is properly enough classed under the head of inorganic manures. It is the remains of the dung, feathers, eggs, food and carcasses of innumerable flocks of marine birds, which have made some of the islands in the Pacific and Atlantic oceans, places of resort for rearing their young through unknown ages. It is found in the Pacific, near the coast of Peru, between latitude 13° and 21° south, where the rain never falls; and in some places it has accumulated to the enormous height of 60 and 80 feet. Yet such has been the demand for this justly popular fertilizer, that over 373,000 tons were imported into England from July 1844, to the same period in 1845, at an average value of $33 per ton. A comparatively small amount has been taken to other countries, including the United States. Its value has been known and appreciated from time immemorial by the Peruvians, who transferred it to the continent, and used it for various crops.

Different specimens vary greatly as to quality. The average analysis of Dr. Ure's examinations is:

Organic matter containing nitrogen, including urate of ammonia, and capable of affording from 8 to 17 per cent. of ammonia by slow change in the soil,........	50
Water 11. Phosphate of lime 25,................	36
Ammonia, phosphate of magnesia, phosphate of ammonia and oxalate of ammonia, containing from 4 to 9 per cent. of ammonia,..........................	13
Silicious matter from the crops of birds,..........	1
	100

The above analysis shows a strongly concentrated manure, and it is certain it is much above the medium, as the sand alone is sometimes 15 or 20 per cent. It is applied to roots, grain and other cultivated crops, and as a top dressing for grass; but it has thus far proved of most value to the former. Before using it as a top dressing, it is mixed with twice its bulk of fine earth, ashes, plaster or charcoal dust. The proper quantity is from 200 to 400 lbs. per acre, sown broadcast and harrowed in, or supplied in two dressings; the first soon after the plants appear, but not in contact with them; the last, 10 or 14 days after, and immediately before moist or wet weather. The crops on poor soils are much improved, while those on rich lands, have in some cases, been injured by it. For hot houses and many minor purposes it is a desirable manure, and in solution it is very convenient as an occasional dressing. It is thus prepared by dissolving 4 lbs. in 12 gallons of water, 24 hours before using. On account of its volatile character, it should be closely covered till wanted.

SOOT,

Like ashes, has its origin exclusively from vegetables, but may with them, be properly treated under the present head. It holds ammonia, charcoal and other rich ingredients, and is used at the rate of 50 to 300 bushels per acre. It produces its greatest effects in moist weather, and in dry seasons, it has sometimes proved positively injurious. It may be sown broadcast over the field and harrowed in, or mixed with such other manures as are intended for immediate use. The ammonia has a great tendency to escape, which can only be prevented, by adequate absorbents, as

earth or the like. Many experiments made with it have proved contradictory. In some, it has been shown to be useless for clovers, while it has proved of great service to several of the grasses. Salt enhances its effects. In an experiment made in England with potatoes, on three separate acres of land of equal quality one without manure, gave 160 bushels; one manured with 30 bushels of soot, yielded 196; and the third, which received the same quantity of soot and seven bushels of salt, yielded 236.

CHAPTER III.

ORGANIC MANURES.

THE PRINCIPLES CONSTITUTING ANIMAL AND VEGETABLE—PUTRESCENT OR ORGANIC MANURES.

From the table in the foregoing pages on the ashes of plants, to which reference has been frequently made, it is shown that in burning dried vegetables, they lose from about 95 to 99 per cent. of their whole weight. The matter that has been expelled by heat, consists of four substances or ultimate principles; carbon, oxygen, hydrogen and nitrogen, of which carbon makes up from 40 to 50 per cent, or about one half of the whole.

Carbon constitutes all of charcoal but the ash; nearly all of mineral coal, and plumbago or black lead; and even the brilliant diamond is but another form of carbon. The properties and uses of carbon are various and important; its agency in the growth of plants alone concerns us at the present time.

Carbonic Acid.—When any matter containing carbon is burnt, its minute particles or atoms combine with the oxygen which exists in the atmosphere, and form carbonic acid, consisting by weight of 6 of the former and 16 of the latter. When animals inhale air into their lungs a similar union takes place; the carbon contained in the system being brought to the surface of the lungs, and after uniting with the oxygen as carbonic acid, is expelled. Pure limestone or marble loses 46 per cent. of its weight by burning; and all of this loss is carbonic acid, which it slowly absorbs again on exposure to the air, or to such substances as contain it. It is evolved by fermentation, and if the surface of a brewer's vat in full activity be closely observed in a clear light, it may be seen falling over the edges, when it gradually mingles with the air. Its density is such that it may be

poured from one open vessel into another, without material loss. It is this which gives to artificial soda water and to mineral springs (as the Saratoga) their sparkling appearance and acid flavor. It abounds in certain caves, sunken pits, and wells, which destroy animal life, not from any intrinsic poisonous qualities, but from its excluding oxygen, which is essential to respiration. And it is from the same cause, that death ensues to such as are confined in a close room where charcoal is burnt.

This acid is an active and important agent in the incessant changes of nature. It is everywhere formed in vast quantities, by subterranean fires and volcanoes. Though heavier than atmospheric air, it mingles with it and is carried as high as examinations have yet been made, constituting in bulk, about one part in 1000 of the atmosphere, and something more than this in weight. Gay Lussac ascended in a balloon 21,735 feet, and there filled a bottle with air, which analysis showed to be identical in composition with that on the surface of the earth. Carbon is one of the great principles of vegetation, and it is only as carbonic acid, that it is absorbed by the roots, leaves and stems of vegetables, and by them is condensed and retained as solid matter.

Oxygen, hydrogen and nitrogen, when uncombined with other substances, exist only as gases. The first makes up nearly one half of all the substances of the globe; and with the exception of chlorine and iodine, it constitutes a large part of every material in the ash of plants. It forms rather over 21 per cent. by measure, and 23 by weight of the whole atmosphere; and about 8 parts out of nine by weight of water, hydrogen making up the remainder. It is absorbed and changed into new products by the respiration of animals, and it is an essential agent in combustion. Oxides are composed of it in union with the metals, alkalies, &c.; and most of the acids, as when combined with other substances, nitrogen, sulphur and phosphorus. Its presence indeed, is almost universal, and the agency which it exerts in vegetable nutrition, is among the most varied and intricate manifested in vegetable life.

Hydrogen is the lightest of all the gases. It is but 1-14th the weight of the atmosphere, and 1-16th the weight of oxygen; and from its great levity, it is used for filling balloons. It burns with a light flame when brought into contact with

atmospheric air on applying a lighted taper, the combustion forming water.

It is largely evolved from certain springs, in connexion with carbon or sulphur, and is called carburetted and sulphuretted hydrogen, an offensively pungent and inflammable gas. So abundantly is this emitted from the earth in some places, that it is used for economical purposes. The inhabitants about the village of Fredonia, N. Y., light their buildings with it; and some of the salt manufacturers in the valley of the Ohio, apply it to evaporating the water of the saline springs. Carburetted hydrogen is the gas now employed for lighting cities. It is manufactured from oils, fat, tar, rosin and bituminous coal, all of which yield large quantities of carbon and hydrogen. Both the carbon and hydrogen are entirely consumed with a brilliant light, when inflamed and exposed to the oxygen of the atmosphere. It is the residuum of these substances, after driving off the gas, which makes the ammoniacal liquor so useful as a manure; all the nitrogen with a part of the hydrogen remaining. In combination with chlorine, one of the elements of salt, it constitutes the muriatic, one of the strongest of the acids.

Ammonia.—The most frequent condition besides water in which hydrogen is mentioned in connexion with vegetation, is when combined with nitrogen in the proportion of 3 of the former in bulk, to 1 of the latter; and by weight, 17.47 of the first, to 82.53 of the last, in every 100 parts, composing the volatile alkali, ammonia, which is about 6-10ths the density of the atmosphere. By strong compression at a low temperature, it may be condensed to a liquid having rather more than 3-4ths the specific weight of water. It is never found in a tangible shape, except in combination with acids, forming carbonates, nitrates, sulphates, muriates, &c. of ammonia.

Nitrogen exists in the atmosphere to the extent of about 79 per cent. The principal purpose it appears to fulfil in this connexion, is in diluting the oxygen, which in its pure state acts with too great intensity on animal life, in combustion, and all its various combinations. So great is the attraction of undiluted oxygen for iron, that a wire ignited by a taper and plunged into a jar of oxygen gas, will itself take fire and rapidly melt into irregular drops. This is nothing more than an illustration of the principle exhibited

(in an intense degree) in the gradual rusting which takes place in the air at its ordinary temperature; or the more rapid formation of the scales under the heat of the blacksmith's forge. All are simple oxidations of the metal, or the combination of oxygen with iron; and we see in the comparison, the immensely accelerated effect produced by the absence of nitrogen.

Nitric acid is another compound of great importance to vegetation. It is simply nitrogen and oxygen; the identical materials which compose the atmosphere, combined in different proportions, 26.15 parts by weight of the former, and 73.85 of the latter in every 100. This acid in union with potash, forms nitrate of potash, or saltpetre; and with soda forms nitrate of soda. The last is found in immense beds and lies upon and immediately under the surface of the earth in Chili, India and Spain. From Chili it is exported in large quantities, and has been extensively used in England of late years, as a manure.

It has been deemed relevant to our subject to say thus much respecting some of the most striking characteristics of those four simple principles, which make up an average of more than 98 per cent. of all living vegetables. And here a moment's reflection irresistibly forces from us an expression of wonder and admiration at that Wisdom and Omnipotence, which, out of such limited means, has wrought such varied and beautiful results. Every plant that exists, from the obscure sea-weed 100 fathoms below the surface of the ocean, to the lofty pines that shoot up 300 feet in mid-air; and from the clinging moss that seems almost a part of the rock on which it grows, to the expanded banyan tree of India, with its innumerably connected trunks, overshadowing acres; every thing that is pleasant to the taste, delightful to the eye, and grateful to the smell, equally with whatever is nauseous, revolting and loathsome, are only products of the same materials, slightly differing in association and arrangement.

BARN-YARD MANURE.

The first consideration in the management of manures, is to secure them against all waste. The bulk, solubility and peculiar tendency to fermentation of barn-yard manure, renders it a matter of no little study so to arrange it as to preserve all its good qualities and apply it undiminished to the soil. A part of the droppings of the cattle are neces-

sarily left in the pastures, or about the stacks where they are fed; though it is better, for various reasons, that they should never receive their food from the stack. The manure thus left in the fields, should be beaten up and scattered with light long-handled mallets, immediately after the grass starts in the spring, and again before the rains commence in the autumn. With these exceptions, and the slight waste which may occur in driving cattle to and from the pasture, all the manure should be dropped either in the stables or yards. These should be so arranged that cattle may pass from one directly into the other; and the yard should if possible, be furnished with running water. There is twice the value of manure wasted annually on some farms in sending the cattle abroad to water, that would be required to provide it for them in the yard for 50 years.

The premises where the manure is dropped, should be kept as dry as possible; and the eaves should project several feet beyond the side of the building so as to protect the manure thrown out of the stables, from the wash of rains. The barns and all the sheds should have eave-troughs to carry off the water, which if saved in a sufficiently capacious cistern, would furnish a supply for the cattle. The form of the yard ought to be dishing towards the centre, and if on sandy or gravelly soil, it should be puddled or covered with clay to prevent the leaking and escape of the liquid manure. The floors of the stables may be so made, as to permit the urine to fall on a properly prepared bed of turf under them, where it would be retained till removed; or it should be led off by troughs into the yard or to a muck heap.

It is better to feed the straw and coarse fodder, which can always be advantageously done by cutting and mixing it with meal or roots. When it is not thus consumed, it may first be used as litter for the cattle, and as it becomes saturated with the droppings, it should be thrown into the yard. If the cattle are fed under sheds, the whole surface ought to be covered with such straw, refuse forage, &c. as can be collected; and if there is a deficiency of these, peat or any turf well filled with the roots of grass, and especially the rich wash from the road side may be substituted. The manure may be allowed to accumulate through the winter, unless it be more convenient to carry it on to the fields. When the warm weather approaches, a close attention to the manure is necessary. The escape of the frost permits circulation of the

air through it, and the increasing heat of the sun promotes its decomposition.

LONG AND SHORT MANURE.—The question has been often mooted as to the comparative advantages of long and short manure, (*the fermented and unfermented.*) This must depend on the use for which they are designed. If intended for the garden beds, or for loose light soils, or as a top dressing for meadows, or any crops, or if needed to kill any noxious seeds incorporated with the heap, it should be fermented; if for hoed crops in clay or loamy soils, it should be used in as fresh condition as possible. Loose soils are still farther loosened for a time by long manure, and much of its volatile parts is lost before it is reduced to mold; while adhesive and compact soils are improved by the coarse vegetables which tend to their separation; and all the gases which are set free in fermentation, are combined and firmly held in the soil.

DECOMPOSITION OF MANURES. — Three conditions are essential to produce rapid decomposition in manure; air, moisture and a temperature above 65°, and these except in frosty weather, are generally present in the heap. The gradual chemical changes going on in all manures, but most actively in the excrements of the horse and sheep where they have sufficient air and moisture, induce an elevation which keeps them always above the low temperature of the surrounding air. If the manure be trodden compactly and saturated with water, the air cannot circulate, and if its temperature be likewise kept down, it will be preserved a long time unchanged. The fermentation of manure should go forward when thoroughly blended with all the vegetable and liquid fertilizers about the premises, including urine, brine, soap-suds, ashes, gypsum and coal-dust; the last three substances combining with the ammonia as it is formed. Over all these should be placed a good coating of turf, peat or fine mould, which will absorb any gases that escape the gypsum, &c. Old mortar or effete lime may also be added for the formation of nitric acid. It draws this not only from the materials in the heap, but largely also from the nitrogen of the air; it having been ascertained in the manufacture of saltpetre, (nitrate of potash,) that the amount of nitrogen in the salt, is greatly increased above that in the manure used. The absorption of nitre by lime in a course of years, is found to be large, as is seen by the practice of the Chinese farmers, who to secure it will gratuitously remove the old plaster on

walls and replace it with new. If required to hasten decay, and especially if there be intractable vegetables, as broom and other corn-stalks, or such as have seeds that ought to be destroyed, they may be well moistened and thrown together in layers three or four inches thick; and on each may be strewn a liberal coating of fresh unslacked lime reduced to powder. This promotes decomposition, and when it is far enough advanced, the whole may be sparingly added to the general mass, as the lime will by that time have become mild. These coarse materials, when remote from the cattle yard, may be at once burned, and the ashes added to the soil, or they may be buried in furrows, where the ground will not be disturbed, till they are entirely rotted.

When thoroughly decomposed, the manure heap will have lost half its original weight, most of which has escaped as water and carbonic acid. It may then be carted on to the ground, and at once incorporated with it; or if intended for a top dressing, it should be scattered over it immediately before or during wet weather. For the protection of the manure, it would be well to cover it with a roof and convey off all the water from the eaves. This will prevent any waste of the soluble matter and promote the escape of moisture by the free circulation of air, which to the extent of this evaporation, will lessen the labor of hauling.

Tanks for holding liquid manure have long been in use. They should be convenient to the stalls and yards, and tight drains should convey into them every particle of the urine and drainage from the manure. In compact clay they may be made by simply excavating the earth, and the sides can be kept from falling in, by a rough wall or by planks supported in an upright position, by a frame-work of joice. But in all cases the cisterns should be *closely covered* to prevent the escape of the ammonia, which is developed while fermenting. In porous soils, it is necessary to construct them with stone or brick laid in water-lime or cement.

When partially filled, fermentation will soon take place in the tank, and especially in warm weather; gypsum or charcoal should then be thrown in to absorb the ammonia. A few days after decomposition commences, it should be pumped into casks and carried on to the land. If intended for watering plants, it must be diluted sufficiently to prevent injury to them. The quantity will depend on the strength of the liquid, and the time it is applied, much less water being necessary to dilute it in a wet than in a dry time. By fer-

menting in the open air and undiluted, it has been found that in six weeks, cow's urine will lose nearly one half of its solid matter or salts, and 6-7ths of its ammonia; while that which had been mixed with an equal quantity of water, lost only 1-18th of the former and 1-9th of the latter. The stables and troughs leading to the tank should be frequently washed down and sprinkled with gypsum. This last will absorb much of the ammonia which would otherwise escape. Some loss of the volatile matter must be expected, and the sooner it is used after proper fermentation or ripeness, as it is termed, the greater will be the economy.

Liquid manure applied to the muck heap. — As a general rule, it is more economical and a great saving of labor to keep the urine above ground and mix it at once with the manure; but in this case vegetable or earthly absorbents must be adequately supplied; and in addition, the heap ought frequently to be sprinkled with gypsum or charcoal. Rich turf, the wash of the road-side, tan-bark or saw-dust, and all refuse vegetables may be used for this purpose, and so placed that the liquid can run on to them, or be deposited where it can be poured over it. The same protection of a rough open shed should be given to this as to the other heaps, to facilitate evaporation and prevent drenching from rains. When fully saturated with the urinary salts and all is properly decomposed, it may be carried out for use, or closely covered with earth till wanted. The decomposition is in a great measure arrested by covering with compact earth thoroughly trodden together; this prevents the access of air, which is essential to its progress.

A simple yet economical mode of saving the liquid manure, is sometimes adopted in Scotland, and is thus detailed:

"We divide a shed into two compartments, one of which we make water-tight, by puddling the side walls with clay to the height, say, of two feet, and separated from the other compartment by a low water-tight wall or boarding. This is my fermenting tank, which is filled half or three parts full of pulverized burnt peat, and the liquid manure from the stable, pigstyes, &c., directed into it. This is mixed up with the pulverized peat, and allowed to remain three or four weeks, till the decomposition seems about completed, being occasionally stirred about after the composition has become about the consistency of gruel. The whole is then ladled (with a pole and bucket) over the low partition into the second floor, which is also three parts filled with the carbonized peat; and as the

second floor is meant merely as a filter, we have it lower on one side than the other, by which means, in the course of a day or two, the carbonized peat is left comparatively dry. The water having passed off at the lower side, the first or fermenting floor is again filled as before, and the contents of the second floor, if considered saturated enough, are then shovelled up into a corner, and allowed to drip, and further dry till used, which may be either immediately, or at the end of twenty years, as scarcely anything will affect it, if not exposed to the continued washing of pure water, or exposed to the influence of the roots of growing plants. By being thinly spread on a granary floor, it soon becomes perfectly dry, and suited to pass through drill machines.

"The mixing of the carbonized peat with the liquid manure on the first or fermenting floor, it will be observed, is for laying hold of the gaseous matters as they escape during the fermentation; perhaps other substances may effect this more effectually, but none so cheaply. I think by this plan it will be obvious to every one that a great many desiderata are at once obtained. In the first place, you get free of over 900 parts out of every 1,000 of the weight and bulk of manure, by the expulsion of the water; while at the same time you link all the fertilizing properties contained in it to one of the most handy vehicles—light, cleanly, and portable, and possessed of the peculiar property of holding together the most volatile substances, till gradually called forth by the exigencies of the growing plants. Lastly, you get free of the tank, hogshead and watering cart, with all its appendages, and are no more bothered with overflowing tank, or overfermented liquid, with weather unsuited to its application. You have merely to shovel past the saturated charcoal, and shovel in a little fresh stuff, and the process goes on again, while the prepared stuffs lie ready for all crops, all seasons and all times."

VALUE OF LIQUID MANURES.—The urine voided from a single cow is considered in Flanders, where agricultural practice has reached a high state of advancement, to be worth $10 per annum. It furnishes 900 lbs. of solid matter, and at the price of $50 per ton, for which guano is frequently sold, the urine of a cow for one year is worth $20. And yet economical farmers will continue to waste urine and buy guano! "The urine of a cow for a year will manure 1¼ acres of land, and is more valuable than its dung, in the ratio by bulk, of 7 to 6; and in real value as 2 to 1."—*Dana.*

How important then, that every particle of it be carefully husbanded for the crops.

The average urine of the cow, as analyzed by Sprengel, contains 92.6 per cent. of water; that of the horse, 94; the sheep, 96; the hog, 92.6; and the human, 93.3. The remainder is composed of salts and rich vegetable food; but the human is far richer in these than any other. The quantity and value of urine varies much, and depends on the food and liquid taken into the stomach, the loss by perspiration, &c.

SOLID ANIMAL MANURES.—Of these *Horse dung* is the richest and the easiest to decompose. If in heaps, fermentation will sometimes commence in 24 hours; and even in mid-winter if a large pile be accumulated, it will proceed with great rapidity; and if not arrested, a few weeks under favorable circumstances, are sufficient to reduce it to a small part of its original weight and value. Boussingault, one of the most careful observers of nature, as well as an accurate experimental chemist, states the nitrogen in fresh dried horse dung to be 2.7 per cent. The same manure laid in a thick stratum and permitted to undergo entire decomposition, loses 9-10 of its whole weight, and the remaining tenth when dried, gives only 1 per cent. of nitrogen Such are the losses which follow the neglect of inconsiderate farmers. Peculiar care should therefore be taken to arrest this action at the precise point desired.

The manure of Sheep is rich and very active, and next to that of the horse is the most subject to heat and decompose. *The manure of Cattle and Swine* being of a colder nature, may be thrown in with that of the horse and sheep in alternate layers. If fresh manure be intermixed with straw and other absorbents, (vegetables, peat, turf, &c.) and constantly added, the recent coating will combine with any volatile matters which fermentation developes in the lower part of the mass. Frequent turning of the manures is a practice attended with no benefit, but with the certainty of the escape of much of its valuable properties. Many farmers assign a distinct or peculiar merit to the different manures. Much of this opinion is fanciful, for there is frequently more difference in the comparative value of that from the same species, and even the same individual, at different times and under different circumstances, than from those of different species.

The diversity in manures may arise from several causes. The more thoroughly the food is digested and its nutritive

qualities extracted, the less is the value of the manure. Thus on the same quantity and quality of food, a growing animal, or a cow in calf, or giving milk, yields a poorer quality of fœces, then such as are not increasing in weight, and if the animal be actually losing condition, the richness of the manure is very much increased. The quality of food adds materially to this difference, the richest giving by far the most valuable manure. Those animals which are kept on a scanty supply of straw or refuse hay, yield manure little better than good turf, and far inferior to the droppings of such as are highly fed. The imperfect mastication of the horse and mule, in comparison with the ruminating animals, the ox and sheep, their generally better quality of food, and the fact that for the greater part of their lives they are not adding to their carcass, is the cause of the increased value of their manure. Their solid fœces are also much richer than those of the cow, as they void less urine and this is of an indifferent character. In a long series of carefel experiments, made at Dresden and Berlin by order of the Saxon and Prussian governments, it was ascertained that soil which would yield 3 for 1 sown, when dressed with cow dung would give 7; with horse dung 10; and with human 14.

POUDRETTE AND URATE.

Poudrette is the name given to the human fœces after they have been mixed with charcoal dust or charred peat, by which it is disinfected of its effluvia, and when dried it becomes a convenient article for use, and even for remote transportation. The odor is sometimes expelled by adding quick lime, but this removes with it much of the ammonia, and on this account should always be avoided.

Urate as well as poudrette, has become an article of commerce. It is manufactured in large cities by collecting the urine and mixing with it 1-6 or 1-7 of its weight of ground gypsum, and allowing it to stand several days. This combines with a portion of the ammonia, after which it is dried and the liquid is thrown away. Only a part of the value is secured by this operation. It is sometimes prepared by the use of sulphuric acid, which is gradually added to urine and forms sulphate of ammonia, which is afterwards dried. This secures a greater amount of the valuable properties of the urine; but even this is not without waste.

Night soil.—From the analysis of Berzelius, the excrements of a healthy man yielded water, 733; albumen, 9; bile, 9;

muscilage fat and the animal matters, 167; saline matters, 12; and undecomposed food, 70; in 1000 parts. When freed from water, 1000 parts left, of ash, 132; and this yielded, carbonate of soda, 8; sulphate of soda, with a little sulphate of potash, and phosphate of soda, 8; phosphate of lime and magnesia, and a trace of gypsum, 100; silica, 16.

Human urine, according to the same authority gives in every 1000 parts; of water, 933; urea, 30.1; uric acid, 1; free lactic acid, lactate of ammonia, and inseperable animal matter, 17.1; mucus of the bladder, 0.3; sulphate of potash, 3.7; sulphate of soda, 3.2, phosphate of soda, 2.9; phosphate of ammonia, 1.6; common salt, 4.5; sal amoniac, 1.5; phosphates of lime acid magnesia, with a trace of silica and of fluoride of calcuim, 1.1.

Urea according to Prout, gives of carbon, 19.99; oxygen, 26.63; hydrogen, 6.65; nitrogen, 46,65. The analysis of Wœhler and Liebig differs immaterially from this. Such are the materials, abounding in every ingredient that can minister to the production of plants, which are suffered to waste in the air, and taint its purity and healthfullness; or they are buried deep in the earth beyond the reach of any useful application, and even in this position, (frequently in villages, and always in cities,) they pollute the waters with their disgusting and poisonous effluvia. The water from one of the wells in Boston examined by Dr. Jackson, gave an appreciable per centage of night soi l!

Treatment of Night Soil. — No perfect mode has yet been devised of managing night soil. For compactness and facility of removal we suggest, that in cities, metallic boxes of sufficient capacity be placed in the privies, so arranged as to be easily taken out in the rear for the purpose of emptying their contents. To prevent corrosion, they should be made of composite or galvanized metal. In the country where it can be at once applied, tight wooden boxes may be used, with hooks on the outer side, to which a team may be attached, for drawing it out wherever required. The boxes should have a coating at the bottom, and successively as they become filled, of charcoal dust, charred peat, or gypsum. These materials are cheap, compact and combine readily with the volatile gasses. Sulphuric acid is more efficient than either but more expensive. Quick lime will neutralize the odor but it expels the enriching qualities, and if it be intended to use the night soil, lime should never be mixed with it. Both, the charcoal and peat condense and retain the gasses in their

pores, and the sulphuric acid of the gypsum leaves the lime, and like the free acid, combines with the ammonia, forming sulphate of ammonia, an inodorous and powerful fertilizer. Raw peat, turf, dry tan bark, saw-dust and ashes are all good; but as more bulk is needed to effect the object their use is attended with greater inconvenience. From its great tendency to decompose, night soil should be immediately covered with earth when exposed to the air. It is always saved by the Flemings and Chinese, the former generally using it liquid, and the latter either as a liquid or mixed with clay and dried like brick.

The use of this manure effectually prevents the propagation of all weeds. Its value like all others, depend much on the food from which it is derived.

THE EXCREMENTS OF FOWLS.

These contain both the fœces and urine combined, and are next to night soil in value. They should be mixed at once with the soil, or with a compost where its volatile matters will be retained. They are very soluble and when exposed to moisture, are liable to waste.

FLESH, BLOOD, &c.

When decomposed, these substances afford all the materials of manure in its most condensed form. Whenever procureable, they should be mixed with 8 or 10 times their weight of dry peat, turf, tan bark or rich garden mould. A dead cow or horse thus buried in a bed of peat, will yield 10 or 15 loads of the richest manure. Butchers offal will give 20 times its weight of more valuable manure than any from his cattle yards.

HAIR, HORNS, HOOFS, PELTS, WOOLEN RAGS, AND THE FLOCKS, AND WASTE OF WOOLEN MANUFACTORIES

Are rich in every organic substance required by plants, and when mingled with the soil they gradually yield them, and afford a permanent and luxuriant growth to every cultivated crop. All animal substances contain about 15 or 18 per cent of nitrogen.

FISH.

Fish are extensively used in this and other countries for manure. The moss-banker, alewives or bony fish frequent the Atlantic coast in countless numbers in the spring, and are there caught in seines, and sold to the farmers by the wagon load. They are sometimes plowed into the soil with a spring

crop; or are more frequently used for growing corn, for which purpose one or two fish are placed in each hill and buried with the seed. This was the system adopted by the Aborigines of our country in raising their maize on exhausted lands, long before their occupancy or even discovery by the whites. There is waste in this practice, as the soils used for corn are generally light sandy, and the slight silicious covering imperfectly combines with the putrefying fish, and much of their gases thereby eludes the plant, to the excessive anoyance of the olfactories for miles around.

The proper method of using them, is by composting with dry peat in alternate layers of about three inches in thickness of fish to nine of peat, and over the whole a coating of 2 to 4 feet of peat is placed. A few months of warm weather suffices to decompose the fish, which unite with the peat, no perceptible effluvia escaping from the heap so effectual is its absorbtion. A strong acid smell is however noticeable, originating in the escape of the acidifying or antiseptic principle, which has kept the peat for ages in a state of preservation, and whose expulsion is the signal for breaking up its own structure. It now passes rapidly into decay, and is soon lost in a mass of undistinguishable vegetable mold, the fruitful bed of new and varied vegetable forms. This compost may remain without injury, for years. Two or three weeks before using, it should be overhauled and intimately mixed, when another fermentation commences with an elevation of temperature. When this ceases, it may be applied to the land, and is suited to nearly all soils and crops.

SEA WEED

Is a powerful aid to the farmer when within convenient distances. It is thrown upon the sea coast by the waves in large windrows, or it is carefully raked up from the rocks or bottom of the bays, either by farmers or those who make it a business to procure and sell it. It may be used as bedding for cattle or litter for the barn yard, or added directly to the compost heap. Where the distance for carrying it would prevent its use, it may be burned and the ashes removed to the land. It has much more saline matter than vegetables which grow on land and yields a more valuable manure.

PEAT.

This substance is seldom found in this country in the purity that characterizes it in many parts of Northern Europe. There, its nearly pure carbonaceous quality admits

of its extensive use as fuel. In the United States it is generally mixed with the wash from the adjacent elevations, which renders it more easily susceptible of profitable cultivation in its native bed, and not less valuable as a fertilizer when applied to other lands. In six different specimens from Northampton, and four from other localities in Massachusetts, Dr. Dana found an average of 29.41 soluble, and 55.03 insoluble geine or humus; and 15.55 of salts and silicates in every 100 parts. The extensive researches of the same intelligent observer have led him to recommend the mixture of 30 lbs. potash, or 20 lbs. of soda ash, or what is more economical and equally efficacious, 8 bushels of unleached wood ashes, with one cord of peat as it is dug from its bed; or if leached ashes be used, they should be mixed in the proportion of one to three of peat. This he considers fully equivalent to pure cow dung in value. He also estimates the salts and humus of 4 cords of peat, as equal to the manure of a cow for one year. The opinion of Mr. Phinney, a distinguished agriculturist of Lexington, Mass., founded on close observation and long practice, is that one part of green cattle dung composted with twice its bulk of peat, will make the whole equal in value to the unmixed dung.

Peat in its natural condition, contains from 70 to over 90 per cent. of water. It should be dug from its bed in the fall or winter for the purpose of draining and exposing it to the action of the atmosphere, when it will be found to have lost about two-thirds of its bulk. In this state it still holds about 65 per cent of water. It may then be carted in to the cattle yards, and used for making composts in any way desired.

MANURING WITH GREEN CROPS.

This system has within a few years, been extensively adopted in some of the older settled portions of the United States. The comparative cheapness of land and its products, the high price of labor, and the consequent expense of making artificial manures, renders this at present the most economical plan which can be pursued. The object of this practice is primarily, fertilization; and connected with it, is the clearing of the ground from noxious weeds, as in fallows, by plowing in the vegetation before the seed is ripened; and finally to loosen the soil and place it in the mellowest condition for the crops which are to succeed. Its results have been entirely successful, when steadily pursued with a due consideration of the objects sought, and the means by which

they are to be accomplished. Lands in many of our Eastern States, which have been worn out by improvident cultivation, and unsalaeble at $10 an acre, have by this means, while steadily remunerating their proprietors for all the outlay of labor and expense by their returning crops, been brought up in value to $50.

The full benefits of green crops seems only to be realized where there is sufficient calcareous matter in the soil. Calcareous soils, or such as have a large proportion of lime, however they may have become exhausted, when put under a thorough course of treatment in which green crops at proper intervals are returned to them, are soon restored to fertility ; and when lime does not exist in the soil, the application of it in the proper manner and quantity will produce the same effect. Gypsum and ashes are the best substitutes, when lime or marl is difficult to be procured.

This system of improvement varies with almost every individual who practices it, according to the quality of his land, the kind of crops to be raised, the facility of procuring manures, the luxuriance of particular crops, &c. We shall state merely the general principles in this, as in most other subjects, and leave to the farmer's judgment to apply them according to his circumstances. It is always better to commence this system while the land is in good condition, as a luxuriant growth of vegetation is as profitable for turning in as for cropping. Buckwheat, rye, and some of the grasses, have been much used for this purpose in this country ; and spurry, the white lupine, the vetch and rape in Europe ; but for the Northern portion of the Union, nothing has been hitherto tried which is so well fitted for the object as red clover.

Clover for Green Manures. This is suited to all soils that will grow anything profitably, from sand, if possessing an adequate amount of fertility, to the heaviest clay if drained of its superfluous water. The seed is cheap, its growth certain and rapid, and the expense of its cultivation trifling, while the return on a kindly soil and with proper treatment is large. Added to this and very much increasing its merits, is the abundance of its long tap roots, which penetrate the ground to a great depth and break up the stiff soils in a manner peculiarly beneficial to succeeding crops. The material yielded by the roots and stubble, is of itself equal to a good dressing of manure. It has the further advantage of giving two or more years growth from one sowing, and of

maintaining itself in the ground thereafter by self seeding when not too closely cropped; and it is equally suited to profitable pasturage and winter forage.

If the first season of growth of clover be luxuriant after the removal of the grain upon which it was sown, it may be pastured in the autumn or suffered to fall and waste on the ground, the first being the most economical. The following year, the early crops may be taken off for hay, and the second, after partially ripening its seeds, may be plowed in, and thus it carries with it a full crop of seed for future growth. It is usual when wheat is cultivated, to turn in the clover when in full flower in July, and allow the ground to remain undisturbed till the proper time for sowing the grain, when it may be cross-plowed if necessary, or the wheat may be sown directly on the ground and harrowed in. This system gives alternate crops of grain and clover, and with the use of such saline manures, as may be necessary to replace those abstracted from the soil, will sustain the greatest fertility. With a slight dressing of these when the land is in good condition, the first crop of clover may be taken off, and yet allow a sufficient growth for turning in.

It is customary however, to adopt a 3 or 4 years course of cropping, in which grain, roots, corn, &c. alternate with clover and barn-yard manures; and this we think the most judicious practice when the land is within convenient distance of the manure. If the fields are remote, a still longer course would be preferable, where stock and particularly sheep are kept, as they might be allowed to pasture the field during a much greater time. Sheep would remove only so much of the forage as remains in their carcass; while milch cows and working animals would of course carry off a greater amount, the first in the milk and the last in their manure dropped while out of the field.

The Cow Pea is a rank, luxuriant producer, and is deemed the best of the fertilizers for the south; as it will there grow two crops in one season from two successive plantings. This is also a valuable fodder for cattle and sheep, and the ripe peas are a profitable crop. Like a luxuriant growth of clover, it requires the roller, to prepare it properly for the plough.

Spurry is extensively used in the north of Europe, Flanders, Germany and Denmark, as a fertilizer and as forage for cattle, both in its green and dry state. It is admirably adapted to the lightest sands, where it is said to grow with more

luxuriance and profit than any other of the cultivated plants. It may be sown in the fall after grain or early roots, and plowed in the following spring. Three crops may be grown on the same land in one season. Van Voght says, by alternating these crops with rye, it will reclaim the worst sands, and yield nearly the same benefits if pastured off by cattle; while it adds materially to the advantages of other manures applied at the same time. It grows spontaneously in many of our fields as a weed, and its cultivation on our lightest sands which are too poor for clover, might be attended with the best effects. Like the cow pea however, it is deficient in the deep, tap roots, which give much of their efficiency to the clover and white lupine.

White Lupine.—This plant has not to our knowledge, been introduced as a field crop in this country; but from the great success which has attended its cultivation in Europe, it is a proper subject of consideration, whether it might not be advantageously introduced among us. It grows freely in all except calcareous soils, and is best suited to such as have a subsoil charged with iron. It is hardy, not liable to injury from insects, grows rapidly and with an abundance of stems, leaves and roots. The latter protects the plant from drought by penetrating through the subsoil for a depth of more than two feet, which they break up and prepare in the most efficient manner for succeeding crops.

The advantages of Green Manures consist principally in the addition of vegetable matter which they furnish to the soil. The presence of this, aids in the liberation of those mineral ingredients which are there locked up, and which on being set free, act with so much advantage to the crop. The roots also, exert a power in effecting this decomposition beyond any other known agents either of nature or art. Their minute fibres are brought into contact with the elements of the soil, and they act upon them with a force peculiar to themselves alone, and which is far more efficacious than the intensest heat or strongest acids, persuading the elements to give up for their own use, what is essential to their maturity and perfection. By substituting a crop for a naked fallow, we have every fibre of the roots in the whole field, aiding the ordinary decomposition which is slowly going forward in every soil.

Clover, and most broad-leaved plants, draw largely for their sustenance from the air, especially when aided by the application of gypsum. By its long tap roots, it also draws much

from the sub-soil, as all plants appropriate such saline substances as are necessary to their maturity, and are brought to their roots in a state of solution by the up-welling moisture from beneath. This last is frequently a great source of improvement. The amount of carbon drawn from the air in the state of carbonic acid, and of ammonia and nitric acid, under favorable circumstances of soil and crop, are large; and when buried beneath the surface, all are saved and yield their fertility to the land; while such as decay on the surface lose much of their value by evaporation and drainage. In the green state fermentation is rapid, and by resolving the matter of plants into their elements, it fits the ground at once for a succeeding crop.

THE FALLOW SYSTEM.

As a means of enriching lands, this was formerly much practised, but it is now entirely discarded by intelligent farmers. It consists in plowing up the land and exposing it naked to the elements, whenever the exhaustion by tillage required it. This practice is founded on the principle, that plants gradually exhaust the soil of such soluble food, potash, soda, &c., as are necessary to their support; and unless they are again given to it in manures, in a form suited to their immediate appropriation by plants, time is requisite for dissolving them in the soil so as to enable them again to support vegetation profitably. Besides the loss resulting from the frequent idleness of the land, naked fallows have this further disadvantage, and especially in light and loose soils; they are exposed to the full action of the sun and rains, and by evaporation and drainage are exhausted of much of their soluble vegetable food.

This system, bad as it is, may yet be absolutely necessary where grain alone is raised, and no manure is applied. But it is always avoidable by substituting fallow crops as they are termed, potatoes, turneps, &c. with manure; or clover or other green crops, as above detailed; by which the land is cleared of weeds and sufficiently enriched for succeeding cultivation. Land is equally well prepared for grain by having been occupied as meadows, if they have been kept in good condition by top dressing and pastures answer the same purpose without them.

CHAPTER IV.

IRRIGATION AND DRAINING.

Irrigation might properly enough be classed under the head of manures, for the materials which it provides are not only food for plants, but they aid also in procuring it from other sources. Water is of indispensable necessity to vegetable life, and the great quantity of it demanded for this purpose, is in most climates amply provided by nature in the stores of rain and dew which almost every where moisten the earth, and especially during the early growth of vegetation when it is most required. In countries where rain seldom or never falls, as in parts of South America, Egypt and elsewhere, the radiation of heat from the surface is so rapid under their clear skies, that excessive deposites of dew, generally supply the plants with all the moisture which they need. The same effect takes place throughout most of the United States in our transparent summer atmosphere, and it is to the presence of copious dews on our rich well cultivated fields, that much of the luxuriance and success is due, which has ever attended enlightened and judicious American husbandry.

Besides the moisture that abounds in the atmosphere, but which is not always available in rains and dews to the desired extent for the wants of vegetation, and that which imperceptibly ascends from remote depths in the earth and administers to the support of plants; it is a practice coeval with the earliest history of agriculture, to bring artificial waters upon the cultivated fields, and make them contribute to the support of the crops. In many countries this system is indispensable to secure their maturity; for although dews accomplish the object in a measure, they do not supply it in the quantity required to sustain a vigorous growth. We find in looking to the practice of Egypt and the Barbary States in Africa; of Syria, Babylon, and other places in

Asia; Italy, Spain and elsewhere in Europe, where husbandry early attained a high rank, that irrigation was extensively introduced. Damascus is one of the most ancient cities on record, (for it is mentioned in Genesis as existing nearly 4000 years ago,) and notwithstanding i's numerous successive masters and its having been frequently subject to plunder and devastation when conquered, it is still a flourishing city, though in the midst of deserts. This is no doubt owing to the waters derived from the "Abana and Pharpar, rivers of Damascus," which are conducted above the city till they gush from the fountains and overspread the gardens, and subsequently water all the adjacent plain. Had it not been for irrigation, Damascus would doubtless ages ago, have followed Palmyra, the Tadmor of the wilderness, into utter ruin. On no other principle than a systematic aud extensive practice of irrigation, can we account for the once populous condition of Judea, Idumea and other vast regions in the East, which to the eye of the modern traveller present nothing but the idea of irreclaimable sterility and desolation. The possession of the "upper and nether springs" was as necessary to the occupant, as possession of the soil.

In those countries where the drought is excessive and rains are seldom to be depended on, water is led on to the fields containing all the cultivated crops, and is made subservient to the growth of each. But in the United States and in the middle and northern part of Europe, where the crops ordinarily attain a satisfactory size without its aid, irrigation is confined almost exclusively to grass or meadow lands.

All waters are suitable for this purpose excepting such as contain an excess of some mineral substances, that are deleterious to vegetable life. Such are the drainage from peat swamps, from saline and mineral springs, and from ore beds of various kinds; and those are most frequent, in which iron is held in solution. Of the spring or ordinary river waters, those are the best which are denominated hard, and which owe this quality to the presence of sulphate or carbonate of lime, or magnesia. Those waters which are charged with fertilizing substances that have been washed out of soils by recent floods, are admirably suited to irrigation. Dr. Dana estimates the quantity of salts (in solution) and geine or humus, which were borne sea-ward past Lowell, on the Merrimac river, in 1838, (a season of unusual freshets,) as reaching the enormous amount of 840,000 tons — enough to have

given a good dressing to 100,000 acres of land. Such waters as have flowed out of the sewers of cities or past slaughter-houses and certain manufactories, and received the rich, vegetable food thereby afforded, are the most beneficial when applied to vegetation. Meadows thus irrigated in the neighborhood of Edinburgh, have rented by the acre, at the large sum of $250 per annum. But when none of these can be procured, pure spring water apparently destitute of any soluble matters, may be advantageously used.

Besides its drainage of different matters from remote distances, water freely obsorbes the gases (carbonic acid, oxygen and nitrogen, &c.,) in proportions altogether different from those existing in the air, and brings them to the roots by which they are greedily appropriated, and in its onward, agitated progress over the field, it again absorbs them from the air, again to be given up when demanded by the roots. When the water is permitted to remain stagnant on the surface, this good effect ceases; and so far from its promoting the growth of the useful and cultivated grasses, they speedily perish and a race of sour and worthless aquatic plants spring up to supply their place.

Another and important office that water fulfils in ministering to the growth of vegetation, is in disposing the soil to those changes which are essential to its full maturity. Gypsum requires 460, and lime 778 times its bulk of water at 60° to dissolve them. Others among the mineral constituents of plants, also require the presence of large quantities of water to fit them for vegetable assimilation.

Time for applying Water to Meadows.—In those regions where the winters are not severe, water may be kept in the fields during the entire season of frosts. This prevents its access to the ground, and on the approach of warm weather the grasses at once start into life, and give an early and abundant. But in general, this system cannot be successfully practiced. The water is admitted at proper intervals, freely during the spring and early part of the summer when vegetation is either just commencing or going forward rapidly. It is sufficient to flood the surface thoroughly, and then shut off the water for a time. In very dry weather this may be done with advantage every night. Continued watering under a bright sun, is an unnatural condition with upland grasses, and could never be long continued without proving fatal to them. Neither should the water be applied after the grasses have commenced ripening. Nature is the

proper guide in this, as in most of the operations of the farmer; and it will be seen how careful she is in ordinary seasons, to provide an affluence of rains for the commencement of vegetation, while she as carefully withholds them when it approaches maturity. After the grass is cut, the water may be again let on to flood the meadows. Pastures may be irrigated at proper intervals, throughout the year.

THE MANNER OF IRRIGATING.—This must depend on the situation of the surface and the supply of water. Sometimes reservoirs are made for its reception from rains or inundations, and sometimes they are collected at vast expense from springs found by deep excavations, and led out by extensive subterraneous ditching. The usual source of supply however, is from streams or rivulets, or copious springs which discharge their water on elevated ground. The former are dammed up to turn the water into ditches or aqueducts, through which it is conducted to the fields where it is divided into smaller rills till it finally disappears. When it is desirable to bring more water on to meadows than is required for saturating the ground, and its escape to fields below is to be avoided, other ditches should be made on the lower sides, to arrest and convey away the surplus water.

The advantages of irrigation are so manifest, that they should never be neglected when the means for securing them are within economical reach. To determine what economy in this case is, we have to estimate from careful experiment, the equivalent needed in annual dressing with manures to produce the same amount of grass as would be gained by irrigation; and to offset the cost of the manure, we must reckon the interest on the permanent fixtures of dam, sluices, &c., and the annual expense of attention and repair.

The quality of grass from irrigated meadows is but slightly infrior to to that grown upon dry soils; and for pasturage it is found that animals do better in dry seasons upon the former, and in wet upon the latter. In Europe, where the disease is common, sheep are more liable to *rot* upon irrigated and marshy lands, than on such as are free from excessive moisture.

THE KIND OF SOILS SUITED TO IRRIGATION.—Light porous soils, and particularly gravels and sands, are the most benefited by irrigation. Tenacious and clay soils are but slightly improved by it unless first made porous by underdraining. It is not only important that water be brought on to the ground,

but it should pass off immediately after accomplishing the objects sought.

The increase from the application of water is sometimes fourfold, when the soil, the season and the water are all favorable, and it is seldom less than doubled. Many fields which in their natural condition, scarcely yield a bite of grass for cattle, when thoroughly irrigated, will give a good growth for years, and without the aid of any manures.

UNDER DRAINING HEAVY AND TENACIOUS CLAY LANDS.

The advancement of agriculture in this country during the few last years, the high price of farming lands and their products within convenient distances of our larger markets, justify the commencement of an intelligent system of draining on such lands as require it. This system has for many years been introduced and largely practiced in England and Scotland, and has resulted in the most signal success. The plan first adopted was, to excavate the land in parallel lines at intervals of 16 to 25 feet, and to a depth of 2 or 3 feet, forming a slightly inclined plane on the bottom, which was from 3 to 6 inches wide and gradually enlarging as it approached the surface. The narrowest drains were arched with inverted turf and clay, and so high as to allow of the requisite space at the bottom for the escape of whatever water might filter through the soil. Others were formed with continuous arched tiles laid on *a sole*, (a flat tile of the same material,) or a board placed on the bottom forming an uninterrupted conductor. Larger ditches were filled with rubble-stone (and in some instances brush,) to a sufficient depth, and then covered with soil. In all cases the smaller ones communicated by their outlets with a large open drain which led the water from the field. These drains were always below the reach of the plow, thus leaving the whole surface of the lands free from any obstruction to cultivation. Two recent improvements have been introduced which materially diminish the expense while they enhance the benefits of the system. They consist in sinking the drain to 4 feet and using baked clay or tile pipes 1½ to 2 inches in diameter, and 12 to 18 inches in length, connected by allowing the descending end to enter the next below it as a socket or by placing the ends close to each other. The trifling opening at each joint, with small holes perforating the top of the tiles, is found to be sufficient to admit all the

water which falls into the drain; while the increased depth at which the drainage takes place, draws the water from a much greater distance. With the depth indicated, it has been found that the drains instead of being required once in 16 to 25 feet, may be placed at intervals of 40 to 50, and accomplish the object with equal success, *and in less time.* The expense of the former plan was from $20 to $30 per acre, while the last is only from $12 to $18.

The advantages of under draining are numerous and important. They take away all the surplus water which exists in heavy or tenacious soils, which in wet seasons are a serious impediment to the successful growth and perfection of vegetation; thus always ensuring a full crop when frequently not one-fourth of a crop is matured on similar undrained soils. They allow of early cultivation in spring and late in autumn, by furnishing a dry, warm soil, which would not admit of cultivation except in the warm part of the season; thus enabling the farmer to grow a greater variety of products where only a few were adapted to the soil before, and to these it gave several weeks' additional growth. It saves all the trouble and waste of surface drains and open furrows, which require that much of the land be left almost in an unproductive state, to serve as conductors of the surplus water. The rains falling on the convex surfaces of the lands, run off rapidly into the furrows, and not only prevent the benefit to the soil which would result from its absorption, but they carry with them much of the fine soil, which is thus allowed to waste.

Rainwater is charged with some of the most important elements of nutrition to plants, and especially contains considerable proportions of carbonic acid and ammonia. If these be permitted to percolate through the soil, the roots of the plants, or in their absence, the elements of the soil itself absorb and form permanent combinations with them. Air also holds vegetable food and it is necessary that this should penetrate through every portion of the soil where the fibres of the roots exist. Soils which are saturated with water do not admit of any air, unless the small proportion combined with the water; and from all such this vital adjunct of vegetation is excluded. The porosity of the land thus secured, facilitates the admission and escape of heat, which last condition is of the utmost consequence in promoting the deposition of dews.

The dense mass of saturated soil is impervious to air and remains cold and clammy. By draining it below the soil, the warm rains penetrate the entire mass, and there diffuse their genial temperature through the roots. Immediately pressing after these, the warm air rushes in and supplies its portion of augmented heat to the land. Porous soils thus readily imbibe heat, and they as readily part with it; every portion of their own surfaces radiating it when the air in contact with them is below their own temperature. This condition is precisely what is adapted to secure the deposit of the dews, so refreshing, and during a season of drought, so indispensable to the progress of vegetation. Dew can only be found on surfaces which are below the temperature of the surrounding air, and rapid radiation of the heat imbibed during the warmth of a summer's day, is necessary to secure it in sufficient profusion for the demands of luxuriant vegetation in the absence of frequent showers.

An insensible deposit of moisture precisely analogous to dew, is constantly going forward in deep, rich, porous soils. Wherever the air penetrates them at a higher temperature than the soils themselves possess, it not only imparts to them a portion of its excess of heat, but with it also, so much of its combined moisture as its thus lessened capacity for retaining latent heat compels it to relinquish. To the reflecting mind imbued with even the first principles of science, these considerations will be justly deemed as of the highest consequence to the rapid and luxuriant growth and full development of vegetable life.

Another essential benefit derivable from drained lands, consists in the advantageous use which can be made of the subsoil plow. If there be no escape for the moisture which may have settled below the surface, the subsoil plow has been found to be injurious rather than beneficial. By loosening the earth it admits a larger deposit of water, which requires a longer time for evaporation and insensible drainage to discharge. When the water escapes freely, the use of the subsoil plow is attended with the best results. The broken earth thus pulverized to a much greater depth and incorporated with the descending particles of vegetable sustenance affords an enlarged range for the roots of plants, and in proportion to its extent, furnishes them with additional means of growth. The farmer thus has a means of augmenting his soil and its capacity for production wholly independent of increasing his superficial acres; for with many crops it mat-

ters not in the quantity of their production, whether he owns and cultivates 100 acres of soil, one foot deep, or 200 acres of soil, half a foot in depth. With the latter however, he has to provide twice the capital in the first purchase, is at twice the cost in fencing, planting and tillage, and pays twice the taxes. The underdrained and subsoiled fields have the further advantage of security and steady development in seasons of drought, as they derive their moisture from greater depths which are frequently unaffected by the parching heat. This secures to them a large yield while all around is parched and withered.*

A more enlarged and general, or what may justly be termed a philanthropic view of this system, will readily detect considerations of great moment, in the general healthfulness of climate which would result from the drainage of large areas, which are now saturated, or in many instances covered with stagnant waters, and which are suffered to pollute the atmosphere by their pestilent exhalations.

SPRING AND SWAMP DRAINING.

Springs are sometimes discovered not by a free or open discharge of their water, but in extensive plats of wet, boggy lands, which are of no farther use than to mire the cattle and bear a small quantity of inferior bog hay. These springs should be sought at the highest point where the ground appears moistened and led away to a ravine or rivulet, by a drain sufficiently deep to prevent the escape of any of the water into the adjacent soil; unless as it sometimes happens, the position and quality of water are suited to irrigation, when it may be conducted over the field for that purpose.

Swamps and Peat beds occur frequently in a hilly country. These are low level, wet lands, whose constant saturation with water prevents their cultivation with any useful plants. The first object in effecting their improvement, is to find an outlet for the escape of the water to a depth of 3 to 5 feet below the surface, according to the area to be reclaimed; the greatest depth above specified being frequently necessary to the effectual drainage at all times, of an extended surface. If the water in the swamp has its origin in numerous springs from the adjoining hills, a ditch should be dug around the entire outer edge of it where it meets the ascending land. If

* The experienced reader will sometimes notice the same ideas repeated under different heads. He must bear in mind that this work is intended *for learners*; and that it is of more consequence thoroughly to impress their minds with important principles, than to study brevity in communicating them.

the water be derived from a rivulet, a broad ditch should be made as direct as possible from its entrance to its outlet, and deep enough to lead off all the water. If these are found insufficient, additional ones may be made wherever required.

CHAPTER V.

MECHANICAL DIVISION OF SOILS.

SPADING.

After selecting a proper soil, and placing it in a suitable condition, as to manuring, draining &c. the next most important consideration is the further preparation of the land for the reception of the seed. In small patches of highly cultivated land, spading is resorted to for breaking up and pulverizing the ground more effectually than can be done with the plow. This is the case with many of the market gardens in the neighborhood of our large cities, and with large portions of Holland, Flanders and other countries of Europe. It is even contended by many highly intelligent and practical farmers in Great Britain, where labor is about half and land and agricultural products nearly twice the the average price with us, that spade husbandry can be adopted for general tillage crops with decided advantage to the farmer. However this may be abroad, it is certain it cannot be practised in this country to any extent until some very remote period.

PLOWING.

This is the most important of the mechanical operations of the farm. The time, the depth and the manner of plowing must depend on the crops to be raised, the fertility and character of the soil and other circumstances.

Plowing clay lands. — Whenever practicable these should be plowed in the fall for planting and sowing the ensuing spring. The tenacity of the soil may thus be temporarily broken up by the winter frosts, its particles more thoroughly separated, and the whole mass reduced to a finer tilth than can possibly be effected in any other manner.

There is a still further and important advantage from this practice which ensues from the attraction existing between the clay and those gases that are furnished from the atmosphere, snow, rains and dews. In consequence of being thus thrown up and coming in contact with them, it seizes upon the ammonia and carbonic and nitric acids which are in the air, and holds them for the future use of the crops; while their great affinity for manures effectually prevents the waste of such as are in it.

The furrows of clay soils should be turned over so as to lap on the preceding and lie at an angle of 45°; and for this purpose the depth of the furrow slice should be about two thirds its width. Thus a furrow 6 inches deep should be about 9 inches wide, or if 8 inches deep, it should be 12 inches wide. This will allow of the furrows lying regularly and evenly, and in the proper position for the drainage of the soil, the free circulation of air, and the most efficient action of frosts which in this way have access to every side of them. Land thus thrown up is found to be finely pulverized after the frosts leave it, and it is comparatively dry and ready for use some time earlier than such as is not plowed till spring. For sowing, land plowed in this manner requires no additional plowing, but it is better fitted for the reception of seed than it can be by any further operation, unless by a slight harrowing if too rough. The different kinds of grain or peas may be dibbled in or sown directly upon the surface and covered by the harrow; and if sown very early, the grass and clover seeds require no covering, but find their best position in the slight depressions which are every where made by the frost, and which the subsequent rains and winds fill up and cover sufficiently to secure a certain growth. When a field is intended for planting and is thus plowed in the preceeding autumn, in some instances, and especially when the soil is full of vegetable manures, as from a rich green sward, a single furrow where the seed is to be dropped, is all that is necessary to be plowed in the spring.

If the land has been previously cultivated, (not in sward,) and is designed for planting, a stiff clay is sometimes ridged up by turning a double furrow, one on each side and so close as partially to lap upon a narrow and unbroken surface, thus leaving the greatest elevations and depressions which can conveniently be made with the plow. The frost and air by this means, have a greater surface to act upon than is afforded by thorough plowing, unless it be in a firm sod, which

maintains its position without crumbling. The advantage of a dry surface and early working are equally secured by this latter method; and to prepare for planting, the furrows need only to be split by running a plow through their centre, when they are ready for the reception of the seed.

PLOWING SANDY OR DRY SOILS.—These require flat plowing, which may be done when they are either quite wet or dry, but never till wanted for use. By exposure to heat, rains and atmospheric influences the light soluble manures are exhaled or washed out, and they receive little compensation for this waste in any corresponding fertility they derive from the atmosphere in return. To insure flat plowing on an old sward, the depth of the furrow should be about one-half its width, and the land or ridges as wide as can conveniently be made, so as to preserve as much uniformity of surface over the whole field as possible.

DEPTH OF PLOWING.—All cultivated plants are benefitted by a deep permeable soil, through which their roots can penetrate in search of food; and a though depth of soil is not fully equivalent to its superficial extension, it is evident that there must be a great increase of product from this cause. For general tillage crops the depth of soil may be gradually augmented to about 12 inches, with decided advantage. Such as are appropriated to gardens and horticultural purposes may be deepened to 15 and even 18 inches to the manifest profit of their occupants. But whatever is the depth of the soil, the plow ought to turn up the entire mass, if within its reach, and what is beyond it should be thoroughly broken up by the subsoil plow, and some of it occasionally incorporated with that upon the surface. The subsoil ought not to be brought out of its bed except in small quantities to be exposed to the atmosphere during the fall, winter and spring, or in a summer fallow; nor even then, but with the application of such fertilizers as are necessary to put it at once into a productive condition. The depth of the soil can alone determine the depth of ploughing; and when that is too shallow, the gradual deepening of it should be sought by the use of proper materials for improvement till the object is fully attained. Two indifferent soils of opposite characters, as of a stiff clay and sliding sand, sometimes occupy the relation of surface and subsoil towards each other; and when intimately mixed and subjected to the meliorating influence of cultivation, they will frequently produce a soil of great value.

Cross Plowing is seldom necessary except to break up tough sward or tenacious soils; and the former is more effectually subdued by one thorough plowing in which the sod is so placed that decomposition will rapidly ensue; and the latter is more certainly pulverized by incorporating with it such vegetables, and long or unfermented manures and the like, as will take the place of the decaying sod. The presence of these in the soil, lessens the labor of cultivation and greatly increases the products.

Subsoil Plowing.—This is a practic of comparatively recent introduction, and it has been attended with signal benefit from the increase and certainty of the crop. It is performed by subsoil plows made exclusively for this purpose. The objects to be accomplished are to loosen the hard earth below the reach of the ordinary plow and permit the ready escape of the water which falls upon the surface; the circulation of air; and a more extended range for the roots of the plants, by which they procure additional nourishment, and secure the crop against drought, by penetrating into the regions of perpetual moisture. When all the circumstances are favorable to the use of the subsoil plow, an increase in the crop of 20, 30, and sometimes even 50 per cent. has been attributed to its operations. Its maximum influence on stiff soils is reached, only where underdraining has been thoroughly carried out. Its benefits have been more than doubted when used in an impervious clay subsoil, where it makes further room for storing up stagnant water; and it is evident they can only aggravate the faults of such subsoils as are naturally too loose and leachy.

PLOWS AND OTHER FARM IMPLEMENTS.

There are plows for almost every situation and soil, in addition to several varieties which are exclusively used for the subsoil. Some are for heavy lands and some for light; some for stony soils, others for such as are full of roots; while still another class are expressly made for breaking up the hitherto untilled prairies of the west. Some are adapted to deep and some to shallow plowing; and some are for plowing around a hill and throwing the furrows either up or down, or both ways alternately; others again throw the soil on both sides, and are used for plowing between the rows of corn or roots. Every farm should be supplied with such plows as are entirely adapted to the different operations required.

The farmer will find in the best agricultural ware-houses, all the implements necessary to his operations, with such descriptions as will enable him to judge of their merits. Great attention has been bestowed on this subject for several years by skilful and intelligent persons, and great success has followed their efforts. The United States may safely challenge the world to exhibit better specimens of farming tools than she now furnishes, and her course is still one of improvement. There are numerous competitors for public favor in every description of farm implements; and an intelligent farmer cannot fail to select such as are best suited to his own situation and purposes.

The best only should be used.—There has been a "penny wise and pound foolish" policy adopted by many farmers in their neglect or refusal to supply themselves with good tools to work with. They thus save a few shillings in the first outlay, but frequently lose ten times as much by the use of indifferent ones in the waste of labor and the inefficiency of their operations. A farmer should estimate the value of his own and his laborer's time as well as that of his teams, by dollars and cents; and if it requires one third, one tenth or even one hundredth more of either to accomplish a given object with one instrument than with another, he should before buying one of inferior quality, carefully compute the amount his false economy in the purchase will cost him before he has done with it. Poor men or those who wish to thrive, can ill afford the extravagance of buying inferior tools at however low a price. The best are always the cheapest; not those of high or extravagant finish, or in any respect unnecessarily costly; but such as are plain and substantial, made on the best principles and of the most durable materials. To no tools do these remarks apply with so much force as to plows. The improvements in these have been greater than in any other instruments, the best saving fully one half the labor formerly bestowed in accomplishing the same work.

HARROWING.

The object of the harrow is three fold; to pulverise the land, to cover the seed, and to extirpate weeds. Unless the land be very light and sandy, the operation should never be performed for either object, except when sufficiently dry to allow of the crumbling down into a fine mellow surface under the action of the harrow. There are several varieties of harrows in use; the tri angular and the square, both some-

times hinged and sometimes double; with long teeth and with short ones, some thickly set together, and some far apart. For pulverising firmly sodded or stiff clay lands, a heavy, compact harrow is required, with strong teeth sufficiently spread; and for lighter lands, or for covering seed, the more expanded harrow, with numerous, small and thickly set teeth. To pulverise soil, the harrow should move as quickly as possible, so as to strike the lumps forcibly, and knock them to pieces; and for this purpose an active team is required. When the land sinks much under the pressure of the horses feet, light animals as mules or ponies are preferable.

THE ROLLER

Is an important implement for many fields. It is always useful for pulverizing the soil, which it does by breaking down such clods and lumps as escape the harrow, and thus renders the field smooth for the scythe or cradle; and it is equally so on meadows which have become uneven from the influence of frost, ant-hills, or other causes. It is serviceable in covering seed by pressing the earth firmly around it; which thus secures moisture enough for germination. But its greatest benefit is with such sandy soils as are not sufficiently compact to hold the roots of plants firmly and retain a suitable moisture. With these it is invaluable, and the proper use of the roller has in some instances doubled the product. Its effect is similar to that produced by the frequent treading in a foot-path; and the observing farmer will not have failed to notice the single thread of thick green-sward which marks its course over an otherwise almost barren field of sand or loose gravel. The thickly woven emerald net-work that indicates the sheep-walks, on similar soils, is principally due to the same cause.

Rollers are variously constructed. The simplest form is a single wooden shaft with gudgeons at each end, which rest in a square frame made by fastening four joists together, a tongue for drawing it being placed in one of its sides. A box may be attached to this frame for the purpose of holding stones and weeds picked up in the field, and for weighting the roller according to the work required. When a roller exceeds 8 or 10 feet in length, it should be divided in the middle and have an iron axle pass through each part, upon which they revolve, taking care to diminish the fric-

tion at the ends by a thick washer. The larger the roller the greater surface is brought into contact with the ground the more level it leaves it, besides giving a much easier draught to the team. To accomplish this without too much increase of weight, they are frequently constructed with heads at the ends and closely covered like a drum. For dividing compact clay lumps or for scarifying meadows, they are sometimes made with large numbers of short, stout angular teeth, which penetrate and crush the clods, and tear up and loosen the old turf and moss of meadows.

THE CULTIVATOR

Has a light frame in the form of a triangular or wedge-harrow with handles behind like those of a plow, and with several small iron teeth in the frame, somewhat resembling a double share plow. They are of various sizes, slightly differing in construction, and are of great utility in stirring the surface of the ground and destroying weeds.

THE DRILL BARROW

Is useful for dibbling in seeds, and when the surface is mellow it will open the furrows for the reception of the seed, and drop, cover and roll the earth firmly over it. The smaller ones are trundled along like a wheelbarrow, by hand; and the larger for field planting, having several fixtures for drilling, are drawn by a horse. They are suited to the smaller seeds, and some have been made to plant corn, beans and peas successfully.

SURFACE OR SHOVEL PLOWS.

These are a cheap, light instrument, much used in England, and to some extent in this country, for paring the stubble and grass roots on the surfaces of old meadows. These are raked together into heaps, and with whatever addition there may be of earth or clay are burnt, and the ashes and roasted earth scattered over the soil. There is an apparent objection to this practice in the expulsion of the carbon and nitrogen stored up in the plants and in the waste of the coarse material of the decaying vegetables which is so useful in effecting the salutary mechanical divisions of clay soils. But by a reference to what has been said on the efficiency of burnt clay or broken brick, their great utility as fertilizers will be seen. This and the ash of the plants remain, and both are useful in quickening the

action of soils and accelerating those changes so beneficial to vegetation; and even the re-absorption of the atmospheric gases, it is probable will more than compensate for their equivalents expelled in burning. The effect is further salutary in destroying grubs, insects and their larvæ, and the seeds of noxious weeds.

CHAPTER VI.

THE GRASSES, CLOVERS, MEADOWS AND PASTURES.

The *order* designated by naturalists as *Graminæ*, is one of the largest and most universally diffused in the vegetable kingdom. It is also the most important to man and to all the different tribes of graminiverous animals. It includes not only what are usually cultivated as grasses, but also rice, millet, wheat, rye, barley, oats, maize, sugar cane, broom corn, the wild cane and the bamboos sometimes reaching 60 feet in height. They are universally characterized as having a cylindrical stem; hollow or sometimes as in the sugar cane and bamboos, filled with a pith-like substance, with solid joints and alternate leaves originating at each joint, surrounding the stem at their base and forming a sheath upwards of greater or less extent; and the flowers and seed are protected with a firm straw-like covering, which is the chaff in the grains and grass seeds, and the husk in Indian corn. They yield large proportions of sugar, starch and fatty matter, besides those peculiarly animal products, albumen and fibrine, not only in the seeds, but also and especially before the latter are fully matured, in the stems, joints and leaves. These qualities give to them the great value which they possess in agriculture.

Of the grasses cultivated for the use of animals in England, there are said to be no less than 200 varieties; while in the occupied portion of this country, embracing an indefinitely

greater variety of latitude, climate and situation, we hardly cultivate twenty. The number and excellence of our natural grasses are probably unsurpassed in any quarter of the globe, for a similar extent of country; but this is a department of our natural history hitherto but partially explored, and we are left mostly to conjecture as to their numbers and comparative quality. From the health and thrift of the wild animals, the buffalo, deer, &c., as well as the rapid growth and fine condition of our domestic animals when permitted to range over the prairies, or through the natural marshes and woods in every season of the year, even during the severe and protracted winters in latitude 44° north,* the superior richness and enduringness of our natural grasses, may be inferred. We shall limit ourselves mostly to those which have been introduced, and successfully cultivated in this country.

TIMOTHY, CAT'S TAIL OR HERD'S GRASS (*Phleum pratense.*)—We are inclined to place the Timothy first in the list of the grasses. It is indigenous to this country and flourishes in all soils except such as are wet, too light, dry or sandy, and is found in perfection on the rich clays and clay loams which lie between 40° and 44° north latitude. It is a perennial, easy of cultivation, hardy and of luxuriant growth, and on its favorite soil, yields from 1½ to 2 tons of hay per acre at one cutting. Sinclair estimates its value for hay when in seed to be double that cut in flower. From its increased value when ripe it is cut late, and in consequence of the exhaustion from maturing its seed, it produces but little aftermath or rowen. It vegetates early in the spring, and when pastured, yields abundantly throughout the season. Both the grass and hay are highly relished by cattle, sheep and horses; and its nutritive quality, in the opinion of practical men, stands decidedly before any other. It is also a valuable crop for seed, an acre of prime grass yielding from

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* The writer has seen large droves of the French and Indian ponies come into the settlements about Green Bay and the Fox river in Wisconsin, in the spring, in good working condition, after wintering on the natural grasses of that region. The pony grass may perhaps be mentioned as one of the principal of the winter grasses in that region. It grows in close, thick, elevated tufts, and continues green all winter, and is easily detected by animals under the snow, by the little hummocks which everywhere indent its surface. The wild rice which lines the still, shallow waters of the streams and small inland lakes of many of the Western States, affords nutritious forage when green or if early cut and dried; and the grain which is produced in great profusion is an exhaustless store to the Indians who push into the thickest of it, and bending over the ripe heads, with two or three strokes of the paddle on the dry stalks, rattle the grain into their light canoes. The wild ducks, geese and swans which yet frequent those waters, fatten on this grain throughout the fall and winter.

15 to 25 bushels of clean seed, which is usually worth in the market from $1.25 to $2.00 per bushel, and the stalks and chaff that remain make a useful fodder for most kinds of stock. It may be sown on wheat or rye in August or September or in the spring. When sown alone or with other grasses early in the season on a rich soil, it will produce a good crop the same year. From its late ripening it is not advantageously mixed with clover unless upon heavy clays which hold back the clover. We have tried it with the northern or mammoth clover on clay, and found the latter though mostly in full blossom, still pushing out new branches and buds when the former was fit to cut. The quantity of seed required per acre depends something on the soil and its condition. Eight quarts on a fine mellow tilth is sufficient, and is equal to 16 on a stiff clay.

THE TALL FESCUE (*Festuca elatior*) would appear by the Woburn experiments to yield more nutritive matter per acre when cut in flower than any other grass cut either in flower or seed. This is a native of the United States, and is best suited to a rich loam. It is not extensively cultivated in this country.

MEADOW FESCUE (*Festuca pratensis*) likes a boggy soil, bears well and produces an early grass much relished by cattle, either green or cured as hay.

SPIKED FESCUE (*F. loleacea*) is adapted to a rich loam, and produces the best of hay and pasture.

THE PURPLE FESCUE (*F. rubra*;) SHEEP'S FESCUE (*F. ovina*;) THE HARD FESCUE (*F. duriuscula*;) THE FLOATING FESCUE (*F. fluitans*,) are all indigenous to this country, and good pasture grasses.

ORCHARD OR COCK'S FOOT GRASS (*Dactylis glomerata*) is indigenous, and for good arable soils and especially for such as are shaded, it is one of the most profitable grasses grown. It should be cut for hay before it is ripe, as in seeding it becomes coarse and hard and is less acceptable to cattle. It is ready for the scythe with the clover, and after cutting, it immediately springs up and furnishes several crops of hay or constant pasturage throughout the season. It should be fed closely to secure a tender succulent herbage. The seed is remarkably light, weighing only 12 or 15 lbs. ber bushel. Twenty to thirty lbs. are usually sown upon one acre; yet ten lbs. on finely prepared soils have been

known to produce a good sod over the entire ground. It flourishes from Maine to Georgia.

SMOOTH STALKED, MEADOW, GREEN, SPEAR OR JUNE GRASS, the (erroneously called) BLUE GRASS OF KENTUCKY (*Poa pratensis*) is highly esteemed for hay and pasture. It is indigenous and abounds through the country, but does not appear to reach perfection north of the valley of the Ohio. It is seen in its glory in Kentucky and Tennessee. The seed ripens in June and falls upon the ground, where the succeeding rains give it vitality and it pushes out its long, rich slender leaves, two feet in height which in autumn fall over in thick windrows, matting the whole surface with lucious herbage. Upon these fields which have been carefully protected till the other forage is exhausted, the cattle are turned and fatten through the winter. It maintains its freshness and nutritive properties in spite of frost and the cattle easily reach it through the light snows which fall in that climate. A warm, dry calcareous soil seems to be its natural element, and it flourishes only in a rich upland.

THE ROUGHISH MEADOW GRASS (*Poa trivialis*) has much the appearance of the *poa pratensis*, but its stalk feels rough to the touch while the other is smooth. It has the further difference of preferring moist or wet loams or clay. It yields well and affords good hay and pasture.

TALL OAT GRASS (*Avena elatior*) is an early luxuriant grass growing to the height sometimes of five feet. It makes good hay but is better suited to pasture. It flourishes in a loam or clay soil.

MEADOW FOX TAIL (*Alopecurus pratensis*) is a highly esteemed grass in England both for meadows and pasture. It grows early and abundantly, and gives a large quantity of aftermath. It is best suited to a moist soil, bog, clay or loam. It is indigenous to the middle states.

PERENNIAL RYE GRASS (*Lolium perenne*) AND BIENNIAL AND ITALIAN DITTO, are all grasses highly esteemed in Europe, but repeated trials in this country have given no satisfactory results. They yield indifferently with us, and easily winter kill. Careful cultivation under favorable circumstances, may yet acclimate and render them useful grasses.

FIORIN GRASS (*Agrostis stolonifera*) has been much lauded in England of late, but has made little progress in the estimation of American farmers, and probably with sufficient

reason. It is a diminutive grass, affording considerable nutriment in a condensed form, and is adapted to a winter pasture. It grows on a moist clay or boggy soil Several of the fiorin family abound in this country, among which is the squitch, couch or quick grass.

THE SWEET SCENTED VERNAL GRASS (*Anthoxanthum odoratum,*) is an early valuable pasture grass, which exhales that delightful perfume, so characteristic of much of the eastern meadow hay. It is a late as well as early grass and luxuriates in a dry sandy loam. It affords two and sometimes three crops in a single season.

RED TOP, HERDS GRASS, FOUL MEADOW, OR FINE BENT (*agrostis vulgaris,*) is a hardy luxuriant grass, loving a very moist soil, and somewhat indifferent as to its texture. The scale of its nutritive properties is put down in the Woburn experiments at a remarkably low rate, being less than one fourteenth of the value per acre of timothy in the seed. We think there must be an error in this estimate, as it grows luxriantly under favorable circumstances and is relished by cattle; but by observing farmers it is seldom cultivated where the better grasses will grow.

UPRIGHT BENT GRASS, HERDS GRASS OR FOUL MEADOW (*Agrostis stricta*) is similar to the foregoing, and by some is deemed only a variety.

FLAT STALKED MEADOW OR BLUE GRASS (*Poa compressa*) is an early dwarfish grass, which abounds in the middle and northern states. It is tenacious of its foothold wherever it intrudes. It possesses little merit as hay, but is valuable for pasture affording as it does a close covering to the ground and yielding much in a small compass.

AMERICAN OR SWAMP COCK'S FOOT (*Dactylis cynosuroides*) is an indigenous swamp grass, yielding a large amount of grass or hay of inferior quality.

RIBBON GRASS (*Phalaris Americana*) is the beautiful striped grass occasionally used for garden borders. It has been highly recommended for swamps, where it is alleged that by transplanting, it supesrsedes all other grasses, and affords a fine quality of hay of an appearance quite different from the upland growth. The writer tried several experiments both with the seed and roots, on a clay marsh without success. Its proper pabulum is probably a carbonaceous soil, such as is found in an alluvial swamp or peat bed.

GAMA GRASS, (*Tripsacum dactyloides,*) is found growing spontaneously on a naked sand beach in Stratford, Ct. and in

other places on our eastern coasts. It has occasionally been much lauded, but is a coarse rough grass at the north, and seems not to be highly prized at the south. We have the opinion of some intelligent men in the latter section, that it is utterly worthless for any stock.

BERMUDA GRASS.—This is considered by Mr. Spalding of Georgia, who examined them both critically from specimens which he raised together, as the *Doub grass of India*, so much commended by Sir William Jones, and so highly prized by the Brahmins. It is by the agriculturists of the south deemed an invaluable grass, yielding 4 or 5 tons per acre on good meadow. Mr. Affleck of Mississippi states the yield of 3 cuttings at "5 to 8 tons per acre on common meadow, that it loses just 50 per cent. of its weight in drying, and is consequently the hardest grass to cut. It is the most nutritive grass known, and to the river planter it is invaluable. There is not a levee on the banks of the Mississippi which could resist for an hour the pressure and attrition of its fearful flood but for their being bound together by this grass." It loves a warm and moist, but not wet soil.

GRAMA ("*la grama*," or the "grass of grasses,") is held in the highest estimation by the Mexicans. It attains a medium height, and is deemed the most nutritious of the natural grasses in our south western frontier prairies, in California and parts of Mexico. It grows on dry, hard, gravelly soils, on side hills, the swells of the prairies, and the gentle elevations in the vallies. The principal value is found in the numerous seeds, which are retained in the pods with great tenacity long after they are ripe, serving as a luxurious food for all the graniverous beasts and fowls of the western region.—(*Dr. Lyman.*)

THE BUFFALO GRASS is found intermixed with the Grama, and seldom grows more than a few inches in height. It forms a thick soft herbage, on which the traveller walks with ease, and reposes when weary, with delight. It yields a rich sustenace to countless herds of wild cattle, buffaloes, deer, antelopes, &c.

TORNILLO OR SCREW GRASS.—This grows in great profusion in the region of the two last grasses, but is most conspicuous on the table lands, and between the rivers and creeks, the tall grass of the lower levels giving place to it as the surface ascends. It is taller than the buffalo, with broader leaves. It bears a seed stock 8 or 10 inches, surrounded by a spiral shaped pod an inch long and one fourth of an inch

diameter, which contains 10 or 12 round flattened seeds.—The herbage is not relished by animals, but the ripened seeds yield a food of great richness, on which innumerable herds of wild cattle fatten for slaughter. Horses, mules and most other animals and fowls subsist upon it.—(*Dr. Lyman.*)

The Prairie Grasses are found abundantly in the western prairies and afford large supplies of nutritious food both as pasturage and hay. As a general rule however, they are coarse, and easily injured by the early frosts of autumn. Some of the leguminosæ, or wild pea vines, which are frequently found among them, yield the richest herbage. We are not aware that any of these grasses have been cultivated with success.

Tussac Grass (*Dactylis cespitosa*) is a luxuriant salt marsh grass, growing in large tufts, and is found in perfection on its native soil, the Falkland islands, between 51° and 52° south, and about 8° east of the straits of Magellan. Capt. Ross describes it as "the gold and glory of those islands.—Every animal feeds upon it with avidity, and fattens in a short time. The blades are about 6 feet long and from 200 to 300 shoots spring from a single plant. About 4 inches of the root eats like the mountain cabbage. It loves a rank wet peat bog with the sea spray over it." Governor Hood of those islands says, "to cultivate the tussac, I would recommend that the seed be sown in patches, just below the surface of the ground, and at distances of about two feet apart, and afterwards weeded out, as it grows very luxuriantly, and to the height of six or seven feet. It should not be grazed, but reaped or cut in bundles. If cut, it quickly shoots up; but is injured by grazing, particularly by pigs, who tear it up to get at the sweet nutty root."

Arundo Grass, (*Arundo alopecurus.*)—Mr. Hooker from the same islands says, "another grass, however, far more abundant and universally distributed over the whole country, scarcely yields in its nutritious qualities to the tussac; I mean the Arundo Alopecurus, which covers every peat bog with a dense and rich clothing of green in summer, and a pale yellow good hay in the winter season. This hay, though formed by nature without being mown and dried, keeps those cattle which have not access to the former grass in excellent condition. No bog, however rank, seems too bad for this plant to luxuriate in; and as we remarked during our survey of Port William, although the soil on the quartz districts was very unprolific in many good grasses

which flourish on the clay slate, and generally speaking, of the worst description, still the Arundo did not appear to feel the change; nor did the cattle fail to eat down large tracts of this pasturage."

We have purposely devoted some space to the description of such new grasses as are indigenous to this continent, and which by their superior value in their native localities would seem to commend themselves to a thorough trial in similar situations elsewhere. There are doubtless others of great merit, which experiment hereafter, will demonstrate to be of singular benefit to the American farmer. The subject of grasses has been but slightly investigated in this country in comparison with its immense importance; and for this reason, with few exceptions, we are at a loss for the true value of the foreign and indigenous grasses to American husbandry.

As an instance of the want of a well established character to some of our cultivated grasses, we quote the opinions of Dr. Muhlenburgh of Pa., who has written ably on the subject, and the late John Taylor, a distinguished agriculturist of Virginia, both of whom place *the tall oat grass* (*Avena elatior*) at the head of the grasses; yet from the investigations made at Woburn it appears among the poorest in the amount of nutritive matter yielded per acre. Dr. Darlington, also of Pennsylvania, does not mention it but gives the following as comprehending "those species which are considered of chief value in our meadows and pastures, naming them in what I consider the order of their excellence. 1. Meadow or green grass, (*Poa pratensis.*) 2. Timothy, (*Phleum pratense.*) 3. Orchard grass, (*Dactylis glomerata.*) 4. Meadow fescue, (*Festuca pratensis.*) 5. Blue grass, (*Poa compressa.*) 6. Ray grass, (*Lolium perenne,*) 7. Red top, (*Agrostis vulgaris.*) 8. Sweet scented vernal grass, (*Anthoxanthum odoratum.*")

The sweet scented, soft grass, or holy grass, (*Holcus odoratus,*) according to the Woburn table is next to the tall fiscue and timothy in point of nutritive matter to the acre, when cut in seed, and it is placed as far in advance of all others in the value of its aftermath; yet scarcely any other authority mentions it with commendation. Without relying on these experiments as an unerring guide for the American farmer, we append the table on the two following pages, as the fullest and most correct we have on the subject, and as affording a useful reference to some of the leading and most valuable of the English grasses, most of which are more or less cultivated in this country.

Table of the Comparative Product and Value of Grasses, as Experimented on at Woburn, by Mr. Geo. Sinclair, *under the direction of the* Duke of Bedford.

BOTANIC AND ENGLISH NAMES OF PERENNIAL GRASSES.	Height in wild state in inches.	Soil employed.	When weigh'd	Wt. per acre when green.	Wt. per acre when dried.	Loss in drying.	64 dr'ms gave nutritive mat'r	Nutritive mat. in one acre.	When in flower.	When in seed.	Proportionate value of the grass in flower to the grass in seed.	General character.
				lbs.	*lbs.*	*lbs.*	*d.gr*	*lbs.*			*Fl'r Sd.*	
Anthoxanthum odoratum * — Sweet-scented vernal grass, ...	12	Sandy loam.	In flower. In seed. L. Math.	7827 6125 6806	2103 1837	5723 4237	1 0 3 1 2 1	122 311 239	April 29.	June 21.	4 to 13	Early pasture grass.†
Holcus odoratus, Host. — Sweet-scented soft grass, ...	14	Rich sand loam.	In flower. In seed. L. Math.	9528 27225 17015	2441 9528	7087 17696	4 1 5 1 4 1	610 2233 1129	April 29.	June 25.	17 to 21	The most nutritive, early grass.†
Alopecurus pratensis — Meadow fox-tail, ...	24	Clay loam.	In flower. In seed. L. Math.	20418 12931 88167	6125 5819	14293 7111	1 2 1 1 2 0	270 461 255	May 30.	June 24.	9 to 6	One of the best meadow grasses.‡
Poa pratensis * — Smooth-stalked meadow grass, ...	18	Bog earth & clay.	In flower. In seed. L. Math.	10209 8507 4083	2871 3403	7337 5104	1 3 1 2 1 3	279 199 111	May 30.	July 14.	......	Good early hay grass.‡
Avena pubescens* — Downy oat grass, ...	18	Rich sand loam.	In flower. In seed. L. Math.	15654 6806 6806	5870 1361	9783 5445	1 2 2 0 2 0	366 212 212	June 15	July 8.	6 to 8	Good pasture grass.†
Poa trivialis* — Roughish meadow grass, ...	20	Manured lgt. loam.	In flower. In seed. L. Math.	7487 7827 4764	2246 3522	5240 4304	2 0 2 3 3 0	233 336 223	June 15.	July 10.	8 to 11	Good on rich moist soils.†
Agrostis stricta* — Upright bent grass, ...	9	Bog soil.	In flower. In seed.	7486 4764	2713 1310	4772 3454	1 2	446 260 47	July 28.	Aug. 30.	8 to 5	‡
Festuca rubra* — Purple fescue grass, ...	12	Light sand.	In flower. In seed. L. Math.	10209 10890 30403	3557 4900	6651 5989	1 2 2 0 1 2	239 340 79	June 20.	July 10.	6 to 8	Good long gr.†
Festuca ovina — Sheep's fescue grass, ...	6	Light sand.	In flower. In seed. L. Math.	.... 5445 3403	....	....	... ...	... 127 66	June 24.	July 10.	......	Good long gr.

[illegible] grass.	24	sand soil.	In seed. L. Math.	26541 11910	13272	13272	3 2 1 2	1451 281	June 24.	July 14.	5 to 7	ductive grass, but coarse.†
Poa angustifolia — Narrow leaved meadow grass.	24	Brown loam.	In flower. In seed. L. Math.	18376 9528	7810 3811	10566 5717	5 0 5 1 . . .	1430 701 . . .	June 28.	July 16.	3 to 2	Excellent hay grass.‡
Trifolium pratense — Red clover.§.	. . .	T. clay.	In seed.	49005	12251	3675	2 2	1914	July 18.	Aug. 6.	. . . . . .	‡
Medicago sativa — Lucern.	36	Cl. lo'm.	In seed.	70785	28314	4271	1 2	7659	July 18.	Aug. 6.	. . . . . .	Best for soil'g.‡
Hedysarum onobrichis — Sainfoin.	. . .	Cl. lo'm.	In seed.	8848	3539	5208	2 2	345	July 18.	Aug. 6.		
Festuca duriuscula* — Hard fescue grass. . .	12	Sandy loam.	In flower. In seed. L. Math.	18376 19075 10209	8269 8575	10110 10481	3 2 1 2 1 1	1004 446 199	July 1.	July 20.	14 to 6	Good for hay or pasture.‡
Festuca pratensis — Meadow fescue grass. . .	30	Bog soil.	In flower. In seed.	13612 19057	6465 7623	7046 11435	4 2 1 2	957 446	July 1.	July 20.	18 to 6	Excellent for early hay.‡
Lolium perenne — Perennial rye grass.	24	Rich brown loam.	In flower. In seed. L. Math.	7827 4492 3403	3222 4492	4494 10481	2 2 2 3 1 0	305 643 53	July 1.	July 20.	10 to 11	Generally esteemed.†
Festuca loliacea — Spiked fescue grass. . . .	36	Rich brown loam.	In flower. In seed. L. Math.	16335 10890 3403	7146 4492	9188 6397	3 0 3 1 1 1	765 553 166	July 1.	July 28.	13 to 12	Most valuable for hay and pasture.‡
Avena elatior — Tall oat grass.	50	Brown loam.	In seed. L. Math.	16335 13612	5717	10617	1 0 1 1	255 265	July 6.	July 28.	. . . . . .	Good long gr.†
Festuca elatior* — Tall fescue grass.	36	Black rich loam.	In flower. In seed. L. Math.	51046 51046 15654	17866 17866	33180 33180	5 0 3 0 4 0	3988 2392 978	June 28.	July 16.	20 to 12	Ex. mead. gr.‡
Festuca fluitans* — Floating fescue grass. . . .	18	St. clay.	In flower.	13612	4083	9528	1 3	372	July 14.	Aug. 12.	. . . . . .	Aquatic grass.
Holcus lanatus* — Meadow soft grass.	24	St. clay loam.	In flower. In seed.	19057 19057	6661 3811	12395 15246	4 0 2 3	1191 898	July 14.	July 26.	12 to 11	Early and productive.‡
Poa fertilis — Fertile Meadow grass	20	Cl. lo'm.	In flower.	14973	7861	7111	4 2	1052	July 14.	July 28.	. . . , . .	An early gr.
Phleum pratense — Meadow cat's tail grass. .	24	Clay loam.	In flower. In seed. L. Math.	40837 40837 9528	17355 19397	23481 21439	2 2 5 3 2 0	1595 3669 297	July 16.	July 30.	10 to 23	Ex. for hay.†
Avena flavescens — Yellow oat grass.	18	Clay loam.	In flower. In seed. L. Math.	8167 12251 4083	2558 4900	5308 7350	3 3 2 1 1 3	478 030 79	July 24.	Aug. 15.	15 to 9	Valuable gr.‡
Agrostis vulgaris — Fine bent grass	18	S. soil.	In seed.	9528	4761	4764	1 2	251	July 21.	Aug. 20.	. . . . . .	An early gr.

* Natives of the U. States. † Best cut in seed. ‡ Best cut in flower. § A perennial.

Sowing Grass Seeds.—As a general rule grass seeds do best when sown early in the spring, on a fine tilth or mellow soil. If this is done while the frost is leaving the ground, no harrowing will be necessary, as the spring rains wash the seed into the honey-comb left by the frost, and secure to it an early germination. They are also successfully sown in August or September, when the fall rains will generally give them sufficient growth to withstand the effects of the succeeding winter, if the land be free from standing or surface water. It has recently been the practice of many judicious farmers, to renovate their old worn out meadows, by giving them a coating of unfermented manure, and then turn the sod completely over. On the surface thus plowed, a dressing of well rotted manure or compost with ashes, is spread and thoroughly harrowed lengthwise of the furrows. The seed is then sown and slightly harrowed in, and the decomposing manure and the stubble and roots of the sod give an immediate and luxuriant growth. Grain may occupy the land with the grass seed ; but if the latter be sown alone and sufficiently thick, the young plants will exclude the weeds and occupy the soil as profitably as can be done with the grain. There is usually a great deficiency of grass seed sown when permanent meadows or pastures are required. The English method is to mix together and sow on a single acre, without any grain, 4 or 5 bushels of various seeds which are the best adapted to the purpose. A quick and full growth rapidly covers the surface with a rich herbage, surpassing in value that of the best natural pastures or meadows.

Lands that should be kept in perpetual grass, are such as are frequently under water, as salt and fresh water meadows ; such as are liable to overflow, as the rich bottom or interval lands upon a river bank ; heavy tenacious clays and mountain or steep hill side land, which is peculiarly liable to wash from rains. The low bottom lands generally receive one or more annual dressings from the overflowing waters. The fertilizing matters thus deposited are converted into hay, and become a reliable source for increasing the muck heap for other parts of the farm without demanding any thing in return. The thick sward of nutricious grasses which nature has so lavishly supplied to them, is an effectual protection against abrasion and waste from the overflowing water, while the crop if at any time submerged, can receive comparatively little injury. If plowed and the

fine loose earth is exposed to a sweeping current, much of the soil and all the crop may be lost.

Strong clay lands cannot be properly worked without much labor, unless when under drained and well filled with manure; and they seldom exist in the former condition in this country. Yet these soils next to the fertile, self sustaining bottom lands, are the most profitable for the various grasses. When put into this crop, after first clearing off the native growth of wood, the fine vegetable mold at the surface, aided by the magazine of supplies contained in the clay below, gives to them the most certain and permanent growth. When once plowed this mold is turned under and the intractable clay takes its place on the surface; which, lacking those peculiarities of color, texture and chemical composition, we have before shown are essential to the most successful vegetation, the grass is thin and comparatively unproductive for years. When necessary to break up such lands, they should be thoroughly manured, evenly laid down, and heavily seeded to grass; and if any deficiency of seed or growth is manifested they should receive an addition of seed with a compost dressing.

The injury to plowing steep side hills is sufficiently apparent, as not only the soluble matters, but many of the finer particles of the soil are washed out and carried far beyond reach. Such lands should be kept in permanent pasture if not suitable for mowing. If fed off by sheep, they drop most of their manure on the higher points which is partially washed down and sustains the fertility of every part. There is still another class of lands that should not be broken up for meadows. These are such as are filled with small stones from the surface of which they have been cleared, but which plowing and harrowing will again bring to it and there leave a perpetual annoyance to the mower.

THE MEANS OF RENOVATING PERMANENT MEADOWS AND PASTURES.—The general theory adopted in regard to pasture lands, is that they are manured sufficiently by the animals feeding on them. This opinion is only partially correct. Pastures wear out less than other lands, but when milch cows and working animals are fed upon them, they carry off much of the produce of the soil which is never again returned to it. Even the wool and carcass of sheep with the ordinary escape of the salts by the washing of the rains, will after a long time, impoverish the land. How much more rapidly when much of the manure and all the milk, which is rich in all

the elements of plants, is daily carried from the soil. To such an extent have the permanent clay pastures of Cheshire, (in England,) been impoverished, that it has been found necessary to manure them with crushed bones, which at once brought up their value more than 100 per cent. There is much phosphate of lime in milk, and bones which are mostly of the same material, are the best manure that could be used for dairy pastures. Wool contains a large proportion of sulphur, and sulphate of lime (gypsum) becomes a proper manure for sheep pastures; but whatever has a tendency to develop vegetation, will generally accomplish the object by yielding all the needful properties. Ashes and salt are of the highest value for pasture lands, and with the addition in some instances, of lime, bones and gypsum, are all that would ever be necessary for permanent pastures. From the peculiar action of these, instead of growing poorer, *pastures may become richer through every successive year.*

Permanent meadow lands if constantly cropped without manures, may be exhausted with much greater rapidity than pastures though this depreciation is much more gradual than with tillage lands. There is no greater mistake than to suppose they will keep in condition by taking off one annual crop only, and either pasturing the aftermath or leaving it to decay on the ground. By recurring to the table of the ash of plants, page 32, it will be seen that the analysis of hay there given shows over 5 per cent., while dried clover yields from 7 to 9 per cent. of earthy matter. Every particle of this is essential to the success of the plant, and yet if the land produces at the rate of 3 tons per acre, they are taken off to the amount of upwards of 300 lbs per annum. No soils but such as are periodically flooded with enriching waters, can long suffer such a drain with impunity. *They must be renewed with the proper manures, or barrenness will ensue.* Ashes, lime, bones, and gypsum, (the latter especially to to be applied to clovers, its good effects not being so marked on the grasses,) are essential to maintain fertility, and to insure the greatest product, animal or vegetable manures must also be added. The proper manner of applying manure, is by mixing in a compost and scattering it over the surface when the grass is just commencing a vigorous growth in spring, or simultaneously with the first rains after mowing. The growing vegetation soon buries the manure under its thick foliage, and the refreshing showers wash its soluble matters into the roots; and even the gases

that would otherwise escape, are immediately absorbed by the dense leaves and stalks which every where surround it. The loss of manure is trifling even in a state of active decomposition, when scattered broadcast under such circumstances.

Pasturing Meadows.—There is no objection to feeding off meadows in early autumn, while the ground is dry and the sod firm. The roots of the grass are rather benefitted than injured by the browsing and the land is improved by the droppings from the cattle. But they should never be pastured in spring. It is economy to purchase hay at any price rather than to spring-pasture meadows.

ROTATION ON GRASS LANDS.—Most soils admit of a profitable rotation or change of crops, and where this is the case it is generally better to allow grasses to make up one of the items in this rotation. Where these are successfully grown in permanent meadows, this change or breaking up is less to be sought on their own account than for the other crops, which do better for having a rich fresh turf to revel in. Thus potatoes are sounder, better and yield more on turf than on old plowed ground; and the grain crops are generally more certain and abundant than on other lands. But there are many of the light soils which retain the grasses only for a short time. These should be placed in a rotation which never assigns more than two years to grass.

TIME FOR CUTTING GRASS.—This must depend on the kind of grass. We have seen that Timothy affords nearly double the quantity of nutriment in seed than it does in flower, and it is then much more relished by stock. Timothy therefore should never be cut except when the seed is formed. The proper time is when it is between the milk and dough state, and will nearly ripen after cutting. Orchard grass on the other hand, although it possesses two-sevenths more nutritive value for hay in the seed, yet as it is more tender, and preferred by stock when cut in flower, and as it continues to grow rapidly afterwards, should be always cut at that time.

CURING GRASS.—Many farmers do not consider the scorching effects of our cloudless July suns, and the consequence is that hay is too much dried in this country. Unless the crop be very large, grass will generally cure sufficiently when exposed in the swath for two days. When shook or stirred out, it should not remain in this condition beyond the first day, as it will lose much of its nutritive juices; nor should

dew or rain be permitted to fall upon it unless in cocks. It is better after partially drying, to expose it for three or four days in this way, and as soon as properly cured place it under cover. It is a good practice to salt hay when put up, as it is thus secured against damage from occasional greenness; and there is no waste of the salt as it serves the double object after curing the hay, of furnishing salt to the cattle and the manure-heap.

THE CLOVERS,

Sometimes improperly called grasses, are botanically arranged in the order, *leguminosæ*, under the same head with the bean, pea, locust, vetches, &c. More than 160 species of clover have been detected by naturalists. Their properties and characteristics are totally unlike the grasses, with which they agree only in their contributing in a similar manner to the support of farm stock. There are many varieties cultivated abroad, but the attention of farmers in this country has been limited to a very few.

The Common Red or Northern Clover, (*Trifolium pratense,*) a biennial, and occasionally on calcareous soils, a triennial, is the species most generally in use in the United States. This is a hardy, easily cultivated variety, growing luxuriantly on every properly drained soil of sufficient strength to afford it nutriment. It has numerous strong well developed stems, branching outwardly and vertically from a single seed, and bearing broad thick leaves which are surmounted by a large reddish purple flower. By the analysis of Davy the whole plant yields an amount of nutritive matter fully equal to any other of the clovers.

Mode of Cultivation.—Clover may be sown broadcast either in August or September, or early in the spring, with most of the cereal grains or the cultivated grasses; or it may profitably constitute a crop by itself. The quantity of seed required per acre depends on the kind of soil. On well prepared loams 10 or 12 lbs. of good seed will frequently give a full covering to the land, while on clay 12 to 16 lbs. are necessary per acre. When sown with the grasses, 4 to 6 lbs. on the first, and 8 to 12 lbs. on the last soil will suffice. An additional amount of seed, as with the grasses, will give a finer quality of hay in consequence of multiplying the number of stalks; and for this purpose, as well as to insure it on every spot of the field, it should always be liberally sown. The covering, like that of grass seeds, should be of the slightest

kind; and when sown very early in the spring or on well pulverized grounds and followed by rains, it will germinate freely without harrowing. After the leaves are developed in the spring, an application of gypsum should be made by sowing broadcast, at the rate of one to three or four bushels per acre. The effect of this on clover is singularly great, and it seems to be augmented by applying it on the leaves. This may perhaps be accounted for in the fact, that besides its other uses, gypsum yields a considerable proportion both of its sulphuric acid and lime to the plant and thus constitutes a direct food. The influence of gypsum is almost incredible in developing the clovers on fields where they were hardly discernable before. This may be witnessed in almost any soil where gypsum has any effect. By sowing a quantity over the grass plat containing either the seeds or plants of the clover, however thin or meagre they may be, an immediate and luxuriant growth distinguishes the spot which has received it, from all the surrounding field. Bones are invaluable manure for the clovers. The table of the ashes shows the great quantity of lime and phosphoric acid (the leading elements of bones) which the clovers contain in comparison with the rye grass which is a type of the other grasses. Thus the red clover has about four times as much lime, twenty-six times as much phosphoric acid, more soda and sulphuric acid, and nearly twice and a half as much potash as the grass. The white clover has about four times the potash; the lucern nearly seven times the lime, and fifty-two times the sulphuric acid contained in the grass.

Such are the various demands of plants and the necessity of providing each with its specific food. And hence the advantage of cultivating a variety of grasses and clover on the same spot. Each, it is true, draws its nutriment from the same elements, but in such unlike proportions that when they cease to yield adequate support to one the soil may still be rich in those which will give luxuriant growth to others. Thus two or more of the forage plants when growing together may each yield a large crop, swelling the aggregate product far beyond what would be realized in the separate cultivation of either. This is one of the instances, and it is sufficiently satisfactory, of the utility of good husbandry in the cultivation of the mixed grasses and forage.

Time for cutting and mode of curing Clover.—Clover should be cut after having fully blossomed and assumed a brownish

hue. By close cutting more forage is secured and the clover afterwards springs up more rapidly and evenly. The swath, unless very heavy, ought never to be stirred open but allowed to wilt on the top. It may then be carefully turned over and when thus partially cured, placed in high slender cocks and remain till sufficiently dry to remove into the barn. The clover may be housed in a much greener state by spreading evenly over it in the mow from 10 to 20 quarts of salt per ton. Some add a bushel but this is more than is either necessary or judicious for the stock consuming it, as the purgative effects of too much salt induce a wasteful consumption of the forage. A mixture of alternate layers of dry straw with the clover, by absorbing its juices answers the same purpose, while it materially improves the flavor of the straw for fodder.

After-management of clover fields.—The second crop of clover may be either saved for seed, mown, pastured, or turned under for manure. As this is usually a biennial when allowed to ripen, the stocks die off after the second year, unless its seeding has been prevented, and the crop is only partially sustained by the seed which may have germinated the second year from the first sowing, or from such as has been shed upon the surface from the seed matured on the ground. The maximum benefit derivable to the soil in the manure of the stubble and roots is attained the second year, as we have seen that the dried roots of the clover at that time are in the proportion of 56 for every 100 lbs. of clover hay produced from them in two years. But the ground is then so full of the roots as to check further accumulation. This then is the proper time for plowing up the field and renewing again its accustomed round of crops. If desirable, the clover may be imperfectly sustained on some soils for a few years by the addition of gypsum, bonedust, ashes and other manures, which will develop and mature the ripened seeds, but the greater tenacity of other plants and grasses, will soon reduce it to a minor product in the field.

Importance of the Clovers.—The great value of the different clovers as forage was well known to the ancients. They were largely cultivated by the early Romans, and since that period, they have been extended throughout a large part of Europe. They were not introduced into Great Britain till the 16th century, but have since constituted a

profitable branch of its husbandry. Their importance has long been acknowledged in the United States. The nutritive matter, although relatively less than from some of the grasses, is yet in the amount per acre, fully equal to the average of any other forage crop which is produced at the same expense. It is early and cheaply raised, it is liable to few or no casualties or insect enemies in this country, and its long tap roots are powerful auxiliaries in the division and improvement of soils. Its broad, succulent leaves derive a large portion of their nutriment from the atmosphere, and thus while it affords a product equal to the best grasses, it draws a large part of it from the common store house of nature without subjecting the farmer to the expense of providing it in his manures.

It is as a fertilizer however, that it is so decidedly superior to other crops. In addition to the advantages before enumerated, the facility and economy of its cultivation, the great amount yielded, and lastly the convenient form it offers for covering with the plow, contribute to place it far above any other vegetable. All the grains and roots do well after clover, and wheat especially which follows it, is more generally free from disease than when sown with any other manure. The introduction of clover and lime in connexion, has carried up the price of many extensive tracts of land from $10 to $50 per acre, and has enabled the occupant to raise large crops of wheat where he could get only small crops of rye ; and it has frequently increased his crop of wheat three-fold where he had before produced it.

It is a common observation of intelligent farmers, that they are never at a loss to renovate such lands as will produce even a moderate crop of clover. Poor clay lands not capable of bearing it, have become so by sowing an early and late crop of oats in the same season and feeding them off on the ground. Poor sandy soils may be made to sustain clover with manure, ashes and gypsum, combined with the free use of the roller. This object is much facilitated by scattering dry straw over the surface, which affords shade, increases the deposite of dew and prolongs its effects. Whenever the period of clover-producing is attained, the improvement of the soil may be pushed with a rapidity commensurate with the inclination and means of the owner.

Harvesting clover seed may be done generally after taking off one crop, or pasturing the field till June, or at

such time as experience shows to be the proper one for leaving it to mature a full crop of seed. Early mowing removes the first weeds, and the second growth of the clover is so rapid as to smother them and prevent their seeding, and the clover is thus saved comparatively clean. It is then mown and raked into very small cocks, and when dried at the top they are turned completely over without breaking, and as soon as thoroughly dried they may may be carried to the threshing floor and the seeds beaten out with sticks, light flails, or with a threshing machine. An instrument with closely set teeth and drawn by a horse is sometimes used for collecting the clover heads from the standing stalks from which the seed is afterwards separated. If wanted for use on the farm, these heads are sometimes sown without threshing. The calyx of the clovers is so firmly attached to the seed as to be removed with difficulty, but if thrown into a heap after threshing and gently pressed together a slight fermentation takes place and the seed is afterwards readily cleaned. A fan or clover machine may be used for cleaning the seed for market. The produce is from three to six bushels per acre which is worth to the farmer from \$3 to \$5 per bushel of 60 lbs.

Southern Clover (*Trifolium medium*) is a smaller species than the *T. pratense* and matures ten or fourteen days earlier, and the soil best suited to it is nearly similar. It does better on a light thin soil than the larger northern and should be sown thicker. Strong clay or rich loamy soils will produce much heavier crops of the larger kind. Experience alone will determine which of these kinds should be adopted under all the circumstances of soil, fertility, &c.

White Creeping Clover (*Trifolium repens.*)—There are several varieties of white clover all of which are hardy, nutritious and self-propagating. Wherever they have once been, the ground becomes filled with the seed which spring up whenever an opportunity is afforded them for growth. They are peculiarly partial to clay lands having a rich vegetable mould on the surface, and the addition of gypsum will at all times give them great luxuriance. Their dwarf character renders them unfit for the scythe, while the dense matted mass of sweet rich food ever growing and ever abundant, makes them most valuable for pasture herbage.

The Yellow Clover, Hop Trefoil or Shamrock (*Trifolium procumbens*) like the white, is of spontaneous growth,

very hardy and prolific. It bears a yellow flower and black seeds. It is one of those unostentatious plants, which though never sown and little heeded, help to make up that useful variety which gives value and permanence to our best pasture lands.

MANY OTHER OF THE MINUTE CLOVERS AND LEGUMINOSÆ, THE WILD PEA, &c., abound in our untilled lands and add much to the value of the forage, although their merits and even their existence are scarcely known.

CRIMSON OR SCARLET CLOVER (*Trifolium incarnatum*) is a native of Italy and much cultivated in France. It bears a long head of bright scarlet flowers, and in southern Europe is a profitable crop. Although it was introduced into this country many years since it has not hitherto commended itself to particular attention as an object of agriculture.

LUCERN (*Medicago sativa*) is one of the most productive plants for forage ever cultivated. It was extensively cultivated by the Greeks, and other nations of antiquity for many centuries, and it has been a prominent object of attention in Italy, Spain, France, Holland and Flanders. Its relative value as compared with clover (*T. pratense*,) is decidedly inferior, while its absolutle value per acre, is much greater. It was early introduced into this country. Chancellor Livingston published his experiments with it in 1791 to '94, by which he estimates that he cut in one season, at the rate of 6 1-5 tons per acre in five cuttings, yielding a profit of over $35 an acre. It bears from three to five crops per annum, containing from three to eight tons of hay. Those who have cultivated it pronounce it hardy and as capable of successful growth in this country as clover, but to reach the highest product, it requires a richness of soil and carefulness of cultivation, which would give an enormous produce to its more humble rival.

Manner of Cultivation.—It must have a deep, dry, loamy soil, free from weeds, and well filled with manure. A suitable crop to precede it is corn or potatoes, heavily manured and kept clean. Plow in the fall, and add 40 bushels crushed bones per acre ; and early in April, harrow throughly, and sow in drills from one to two and a half feet apart at the rate of 8 or 10 lbs. seed per acre. Stir the ground and extirpate the weeds with the cultivator or horse and hand hoe. It may be lightly cropped the first year, and more freely the second, but it does not attain full maturity till the third. The roots strike deep into the ground, and being a perennial, it requires no renewal, except from the loss of the plants by

casualties. It should be cut before getting too heavy, and cured like clover. Liquid manure is good for it, as are also gypsum and ashes. Barn yard manure is occasionally necessary, but to avoid weeds, it must be thoroghly fermented to destroy all the seeds. It is sometimes sown broad cast, but the rapid progress of weeds, grass, &c. in the soil will soon extirpate it if they are suffered to grow; and there is no other means of effectually eradicating them but by cultivating the lucern in drills, and the hoe and cultivator can then keep the weeds in subjection. It is one of the most valuable plants for soiling. From the care and attention required, the cultivation of lucern is properly limited to an advanced state of agriculture and a dense population, where labor is cheap and products high. In the neighborhood of large cities it may be advantageously grown, and in all places where soiling is practiced.

Sain-foin (*Hedysarum onobrychis*,) *the esparcette* of the French, is a native of the chalk soils of Europe and is adapted only to strong calcareous lands. On such it is a valuable herbage, as the roots penetrate to a great depth and yield large burdens of nutritious fodder. Though often attempted, we are not aware that it has been raised to any extent in this country.

Bokhara or Sweet-scented Clover (*Melilotus major*) is a tall, shrub-like plant, growing to the height of 4 to 6 feet with branches whose extremities bear numerous small white flowers of great fragrance. When full grown it is too coarse for forage, but if thick and cut young it yields a profusion of green or winter fodder. It should be sown in the spring with about 2 lbs. of seed per acre, in drills 16 to 20 inches apart; it must be kept clear of weeds and cultivated like lucern. It requires a rich, mellow, loamy soil. There are some other plants which might probably be introduced into American husbandry for forage with decided advantage. Among these is

Spurry (*Spergula arvensis.*)—It is a hardy plant which grows spontaneously in the middle states. Its chief merit consists in its growing on soils too thin to bear clover. On such it can be judiciously used to bring them up to the clover bearing point, from which they can be taken and carried forward much more rapidly by the clovers. Van Voght says, "it is better than red of white clover; the cows give more and better milk when fed on it, and it improves the land in an extraordinary degree. If the land is to lie several years in

pasture white clover must be sown with it. When sown in the middle of April it is ripe for pasture by the end of May. If eaten off in June, the land is turned flat and another crop is sown which affords fine pasture in August and September. This operation is equivalent to a dressing of ten loads of manure per acre The blessing of spurry, *the clover of sandy lands*, is incredible when rightly employed." Three crops can be grown upon land in one season which if turned in or fed on the ground, can be made a means of rapid improvement.

PASTURES.

It is too often the case, that pastures are neglected and like woodlands are allowed to run to such vegetation as unassisted nature may dictate. As a necessary consequence, their forage is frequently meagre and coarse and incapable either in quantity or quality of suppporting half the number of cattle in poor condition, that might otherwise be full fed from them. But if we consider that pastures furnish most of the domestic stock with their only food for seven months of the year at the north, and generally for ten months at the south, they may well be deemed worthy the particular attention of the farmer.

Pastures ought to be properly divided; and it is perhaps a difficult point to determine between the advantge of small ranges, and the expense and inconvenience of keeping up numerous divisions. The latter requires a large outlay on every farm, not only for the first cost of material and annual repairs, but from the loss of land occupied by them; and they are further objectionable from their harboring weeds and vermin. Yet it is beneficial to give animals a change of feed, and the grass comes up evenly and grows undisturbed, if the cattle be removed for a while. There is a further advantage in being able to favor some particular individuals or classes of animals. Thus fattening stock ought to have the best feed; milch cows and working animals the next; then young stock; while sheep will thrive on shorter feed than either and greedily consume most plants which the others reject. By this means a field will be thoroughy cleansed of all plants which animals will eat, and the remainder should be extirpated. The same care should be taken to prevent the propagation of weeds in pastures as in other fields. Many of these, mullen, thistle and the like, multiply prodigiously from sufferance, and if unchecked will soon overspread the farm.

Every pasture should if possible, be provided with running water and shade trees, or other ample protection against a summer's sun. The last can at all times be secured by a few boards supported on a light, temporary frame. Excessive heat exhausts and sometimes sickens animals, and consequently it materially diminishes the effects of food in promoting their secretion of milk, the growth of wool, flesh, &c. Pastures ought to be protected against poaching in the spring or late in the autumn. All grounds immediately after long and late rains in the fall or the winter's frosts, are liable to this when exposed to the hoofs of cattle, particularly clay lands and such as have been recently seeded. On late, and off early, is a good rule to be adopted for spring and fall pasturing. Wherever the grasses disappear, fresh seeds should be added and harrowed in; mosses should be destroyed; they should be properly drained and every attention paid to them that is bestowed on the mowing lands, except that they seldom require manures. But ashes, gypsum, lime, &c., may frequently be applied to them with great profit. Pastures should take their course in rotation when they get bare of choice herbage or full of weeds and it is possible to break them up advantageously. Though many choice, natural forage plants may thus be destroyed, yet if again turned into grass at the proper period and they are sown with a plentiful stock of assorted grass seeds on a rich and well prepared surface, they will soon place themselves in a productive state.

CHAPTER VII.

GRAIN AND ITS CULTIVATION.

WHEAT (*Triticum*).

This is one of the most important and most generally cultivated of the cereal grains, (or grasses as they are botanically termed,) though both rice and maize or Indian corn, contribute to the support of a larger population. It is found in every latitude excepting those which approach too nearly to the poles or equator, but it can be profitably raised only within such as are strictly denominated temperate. Linnæus describes only six varieties, but later botanists enumerate about thirty, while of the sub-varieties there are several hundred. The only division necessary for our present purpose is of the winter wheat, (*Triticum hyburnum*) and spring or summer wheat (*Triticum æstivum*). The former requires the action of frost to bring it to full maturity, and is sown in Autumn. Germination before exposure to frost, does not however, seem absolutely essential to its success, as fine crops have been raised from seed after having been saturated with water and frozen for some weeks, and sown early in spring. It has also been successfully raised when sowed early in the season and while the frost yet occupied the ground. Spring and winter wheat may be changed from one to the other by sowing at the proper time through successive seasons, and without material injury to their character. The latter grain is by far the most productive, the straw is stouter, the head more erect and full, the grain plumper and heavier, and the price it bears in market, from 8 to 15 per cent. higher than that of spring wheat. This difference of price depends rather on the appearance of the flour and its greater whiteness, than on any intrinsic

deficiency in its substantial qualities. The analysis of Davy gave in 100 parts of

	Gluten.	Starch,	Insoluble matter.
Spring wheat of 1804,	24	70	6
Best Sicilian winter wheat,	21	74	5
Good English winter wheat of 1803	19	77	4
Blighted wheat of 1804	13	53	34

This analysis gives the greatest nutritive value to the spring wheat, as the gluten constitutes the most important element in flower, resembling so nearly as it does animalized matter. It will also be noticed that the Silician yields about 2 per cent more gluten than the English, which enables the flour to absorb and retain a much larger proportion of water when made into bread. This is what is termed by the bakers, *strength;* and when gluten is present in large proportions, other qualities being equal, it adds materially to the value of flour. American wheat also contains more gluten than English, and that from the southern states still more than that from the Northern. An eminent baker of London says, American flour will absorb from 8 to 14 per cent. more of its own weight of water when manufactured into bread or biscuit than their own; and another reliable authority asserts, that while 14 lbs of American flour will make 21½ lbs of bread, the same quantity of English flour will make only 18½ lbs. As a general rule, the drier or hotter the climate in which the grain is raised, the greater is the evaporation and the more condensed is the farina of the grain, and consequently, the more moisture it is capable of absorbing when again exposed to it. Certain varieties of wheat possess this quality in a higher degree than others. Some manures and some soils also give a difference with the same seed, but for ordinary consumption, the market value (which is the great consideration with the farmer,) is highest for such wheat as gives the largest quantity of bright flour, with a due proportion of gluten. Other prominent differences exist among the leading cultivated varieties of wheat, such as the bearded and bald or beardless, the white and red chaff, those having large and strong stalks, or a greater or a less tendency to tiller, or to send out new stems, &c., &c. There is great room for selection in the several varieties, to adapt them to the different soils, situations, and climate for which they are designed.

Preparation of the Land for Sowing.—Wheat is partial to a well-prepared clay or heavy loam, and this is

improved when it contains either naturally or artificially a large proportion of lime. Many light and all marly or calcareous soils, if in proper condition, will give a good yield of wheat. Lime is an important aid to the full and certain growth of wheat, checking its exuberance of straw and its liability to rust, and steadily aiding to fill out the grain. A rich mellow turf or clover ley is a good bed for it; or land which has been well manured and cleanly cultivated with roots or corn the preceding year. Fresh barn-yard manure applied directly to the wheat crop, is objectionable, not only from its containing many foreign seeds, but from its tendency to excite a rapid growth of weak straw, thus causing the grain both to lodge and rust. The same objection lies against sowing it on rich alluvial or vegetable soils; and in each, the addition of lime or ashes, or both, will correct these evils. A dressing of charcoal has in many instances, been found an adequate preventive; and so beneficial has it proved in France, that it has been extensively introduced there for the wheat crop. A successful example of uninterrupted cropping with wheat through several years, has been furnished by a Maryland farmer, who used fresh barn-yard manure with lime. But this is an exception not a rule, and it will be found that profitable cultivation requires, that wheat should take its place in a judicious rotation. The great proportion of silica in the straw of cereal grains, (amounting in wheat, barley, oats and rye, to about four-fifths of the total of ash from the grain and straw,) shows the necessity of having ample provision made for it in the soil, in a form susceptible of ready assimilation by the plant. This is afforded both by ashes and from the action of lime upon the soil.

Depth of soil is also indispensable to large crops. The wheat plant has two sets of roots, the first springing from the seed and penetrating downwards, while the second push themselves laterally near the surface of the ground from the first joint. They are thus enabled to extract their food from every part of the soil, and the product will be found to be in the ratio of its extent and fertility. Under-draining and sub-soil plowing contribute greatly to the increase of crops, and it is essential that any surface water be entirely removed. Wheat on heavy clay lands are peculiarly liable to winter kill unless they are well drained. This is owing to successive freezing and thawing, by which the roots are broken or thrown out. When this is done to a degree that will

materially diminish the crop, the naked spots may be sown with spring wheat. Any considerable portion of the latter will lessen the value for sale, but it is equally good for domestic use. The land should be duly prepared for the reception of the seed by early and thorough plowing, and harrowing if necessary.

SELECTION AND PREPARATION OF SEED.—Many persons select their seed by *casting* or throwing the grain to some distance on the floor, using only such as reaches the farthest. This is a summary way of selecting the heaviest, plumpest grain, which if Sprengel's theory be correct, is attended with no advantage beyond that of separating it from the lighter seeds of chess or weeds. It is certain that the utmost care should be taken in removing every thing from it but pure wheat, and this should be exclusively of the kind required. When wheat is not thoroughly cleaned by casting, a sieve or riddle should be used, or it should even be picked over by hand, rather than sow anything but the pure seed. Previous to sowing, a strong brine should be made of salt and soft water, and in this the grain should be washed for five minutes, taking care to skim off all light and foreign seeds. If the grain be smutty this washing should be repeated in another clean brine, when it may be taken out and intimately mixed with one-twelfth its bulk of fresh pulverized quick lime. This kills all smut, cleans out weeds from the grain, and insures early rapid growth. When the seed is not smutty, it may be prepared by soaking or sprinkling it with stale urine and afterwards mix with the lime; and if well done this also will prevent smut though the first is most certain. (See "varieties of seed" following for further directions.)

QUANTITY OF SEED AND TIME OF SOWING.— On well pulverized, ordinary wheat soils, about 5 pecks of seed is sown to the acre, while rough land, clay soils and such as are very fertile, require from 6 to 8. In Maryland, but 3 pecks are frequently sown to the acre, and some of the best crops have been raised from only 2 pecks of seed on a finely pulverized soil. It takes more seed when full and plump than when shrunken, as there may be nearly two of the latter to one of the former in the same measure. A difference is to be observed according to the kind of wheat, some needing more than others. A larger quantity of seed produces an earlier growth of lighter straw and head, but does not usually increase the aggregate crop. There is always a tendency

in wheat and most of the cereal grasses to tiller or send out new shoots for future stalks. This is a law of these plants, which compels them to make the greatest effort to cover the whole ground, and sometimes a single seed will throw out more than 100 stalks. In early sowing, the wheat tillers in the autumn; in late sowing this is done in part only till the ensuing spring. Thick sowing is a substitute for tillering to the extent that would otherwise be induced, and is equivalent to earlier sowing of a smaller quantity. The time for sowing in our Northern states is from the 10th to 20th September. If sown earlier it is liable to attack from the Hessian fly, and if later, it does not have time to root as well, and is in more danger of being thrown out by the frost or of winter killing. Late sowing is also more subject to rust the following season from its later ripening.

Sowing.—When the ground has been well mellowed, the seed may be sown broadcast and thoroughly harrowed in. Rolling is a good practice as it presses the earth closely upon the seed and facilitates germination, and as soon as the seed is covered the water furrows should be cleaned out, and again late in autumn and early in the following spring. In northern Europe it has been found a preventive against winter killing on strong clays, to sow the wheat in the bottom of each furrow 6 inches deep, and cover it with the succeeding one. The wheat thus planted, comes up as soon as on the fields sown broadcast and harrowed, grows more vigorously, withstands the winters and produces large crops. Lightly plowing in wheat is perhaps under any circumstances better than harrowing, as the wheat is thereby all buried, and at a more suitable depth than can be done by the harrow. The roughness of the furrows when left without harrowing, is advantageous in heavy or clay lands, and only injurious in light or sandy.

After Culture.—Harrowing in the spring by loosening the soil, adds to the growth of the crop, and the loss of the few plants is much more than compensated by the rapid tillering and vigor of those which remain. Sowing in drills and hoeing between them is much practiced in Europe. The additional amount thus frequently raised would seem to justify the adoption of this mode of cultivation in this country; and it should at least be done so far as to give it a fair trial. On light soils, rolling the wheat both in fall and spring is highly advantageous. When the growth is luxuriant, decided benefit has attended feeding off the wheat on

the field in the fall or spring, taking care to permit the animals to go on only when the ground is firm.

ENEMIES OF WHEAT.—These are numerous. It is subject to the attack of the Hessian Fly if sown too early in the fall, and again the ensuing spring, there being two annual swarms of the fly early in May and September. When thus invaded, harrowing or rolling, by which the maggots or flies are displaced or driven off is the only remedy of much avail. Occasionally other flies, and sometimes wheat worms commit great depredations. There is no effectual remedy known against any of these marauders, beyond rolling, brushing and harrowing. Dusting the grain with lime, ashes and soot, have been frequently tried, as have also the sprinkling them with urine, dilute acids, &c.; and also by fumigating them in the evening when the smoke creeps along through the standing grain. For this last purpose a smouldering heap of damp brush, weeds, or chips, is placed on the windward side of the field, and its efficacy may be increased by the addition of brimstone. Whenever obnoxious to these attacks, the only safety is to place the crop in the best condition to withstand them by hastening its growth, and by the propagation of the most hardy varieties. An application of unleached ashes in damp weather will sometimes diminish the ravages of worms at the root. Quck lime has the same effect on all insects with which it comes in contact, but it should be carefully applied to avoid injury to the plants.

Smut is a dark brown or blackish parasitic fungus, which grows upon the head and destroys the grain. The only remedy for this, is washing in two or three successive strong brines, and intimately mixing and coating the seed with quick lime.

Rust affects the straw of wheat while the grain is forming and before it is fully matured. It is almost always present in the field, but is not extensively injurious except in muggy (close, showery and hot) weather. The straw then bursts from the exuberance of the sap, which is seen to exude, and a crust or iron colored rust is formed in longitudinal ridges on the stalk. It is generally conceded that this rust is a fungus or minute parasitic plant which subsists on the sap; but whether it be the cause or consequence of this exudation is not fully determined. There is no remedy for this when it appears, and the only mitigation of its effects, is to cut and harvest the grain at once. The straw in this

case will be saved, and frequently a tolerable crop of grain which partially matures after cutting; while if suffered to stand, both straw and grain will be almost totally lost. The only preventives experience has hitherto found, are the selection of hardy varieties of grain which partially resist the effects of rust; sowing on elevated lands where the air has a free circulation; the abundant use of saline manures, salt, lime, gypsum, and charcoal; the absence of recent animal manures; and early sowing which matures the plant before the disease commences its attack.

Harvesting.—The grain should be cut immediately after the lowest part of the stalk becomes yellow, while the grain is yet in the dough state and is easily compressible between the thumb and finger. Repeated experiments have demonstrated that wheat cut then, will yield more in measure, of heavier weight, and a larger quantity of sweet white flour. If early cut, a longer time is required for curing before threshing or storing.

Threshing is usually done among extensive farmers, with some one of the large horse machines taken into the field. The use of machines enables the farmer to raise some of the choicest kinds of grain, whose propagation was limited before their introduction, by the great difficulty of separating the grain from the head. He can also push his wheat into the market at once if the price is high, which is frequently the case immediately after harvest; and they save all expense and trouble of moving, storing, loss from shelling, and vermin, interest, insurance, &c. For the moderate farmer, a small, single or double horse machine, or hand threshing in winter where there is leisure for it, is more economical than the 6 or 8 horse thresher.

Mowing or stacking.—When stored in the straw, the grain should be so placed as to prevent heating or molding. This can only be avoided, unless very dry before carrying into the barn, by laying it on scaffolds where there is a free circulation of air around and partially through it. If placed in a stack, it should be well elevated from the ground; and if the stacks are large, a chimney of lattice or open work should be left from the bottom running through the centre to the top; or a large bundle may be kept at the surface in the centre, and drawn upwards as the stack rises, thus leaving an opening from the bottom to the roof. Additional security would be afforded by similar openings horizontally at suitable intervals, so as to admit the air from one side to the other.

Mice and rats may be avoided by laying the foundation of the stack on posts or stones elevated beyond their reach, and covered at the top with projecting caps. Weevils sometimes affect the grain after storing. These may be almost if not wholly prevented by thorough cleanliness of the premises where the grain is stored.

The straw and chaff of wheat should never be wasted. This is the most nutritious of the cereal straws, and yields good fodder to cattle in time of scarcity, and is always valuable for this object when cut and mixed with meal or roots; and particularly when early harvested and well cured. Turneps and straw are the only food of half the cattle and most of the sheep throughout Great Britain, and nowhere do they thrive more or better remunerate their owners than in that country. It is of great use also as bedding for cattle, and as an absorbent of animal and liquid manures. It furnishes in itself the best manure for succeding grain crops; containing large proportions of the salts or ash required. When threshed on the field, and not wanted for cattle, it should be scattered over the ground and either plowed in or suffered to decay on the surface.

VARIETIES OF SEED.—Much depends on the judicious selection of seed. Some soils are peculiarly adapted to wheat growing, and on these should be sown the finest varieties, which are generally of a more delicate character. Wheat on other soils, is liable to many casualties, and on such only the hardier kinds should be propagated. Careful and repeated experiments with different varieties of seeds, on each field or on those which are similar, will alone determine their adaptation to the soil. There are several choice varieties of winter wheat in cultivation in the United States, some of which stand higher in one, and some in another section. Some in high repute abroad, have been introduced into this country and proved to be valuable acquisitions, while others have been found on trial, decidedly inferior to many of the long adopted varieties. Experiment alone will enable the farmer to decide as to their value for his own grounds, however high they may stand elsewhere. When of a fine quality and found to produce well on any given soils, their place should not be usurped by others till repeated trials have shown their superiority either in yield or quality. But when the acclimated grain is inferior, other seed from remote distances, even if no better in quality, may properly be substituted for it, as a decided benefit has been found to follow an exchange.

Wheat and nearly all seeds are found to be more productive when taken from a soil inferior to the one intended for sowing; and it is claimed that what is produced both in a warmer and colder climate will mature earlier. It is not essential that the fullest, heaviest grain be sown. Sprengel affirms that seed somewhat shrunken is more certain to give a good yield than the choicest seed; and numerous trials would seem to favor this conclusion. The grain designed for seed should be well ripened before harvesting. From the ever varying character of the different kinds of seed, their superiority at one time and on one locality, and their inferiority at other times and in other situations, it seems almost superfluous to give a particular enumeration of the present most popular kinds. A brief mention of such only as stand high in public favor in this country, with some of their most striking peculiarities, is all that our limits will admit.

The improved flint is extensively cultivated in the fine wheat growing country of western New-York; where it was introduced in 1822. It is hardy and withstands the winters remarkably well. A striking improvement in the strength of its straw has been observed, which at first inclined to lodge, but it is now erect and firm till fully ripened. The heads are also fuller and longer than when first introduced; the berry is plump and white, yielding a large proportion of choice flour; and it is retained in the head with great tenacity which is a decided advantage for econamy in harvesting, where threshing machines are substituted for the flail.

The old Genesee red chaff is a bald white wheat, first cultivated in the same region in 1798; and for a long time it was the decided favorite. Since 1820 however, it has been very subject to rust and blast, but when circumstances are favorable it is still found to be highly productive. Its transfer to other localitities, may therefore be attended with great success.

The white May of Virginia was a choice variety and extensively raised in the neighborhood of the Chesapeake bay in 1800, but is now nearly extinct there. It has been cultivated in New-York for 10 years, is a good bearer, very heavy; weighing frequently 66 lbs. per bushel, and ripens early, by which it escapes rust.

The Wheatland red is a new variety discovered and propagated by Gen. Harmon of Monroe co., N. Y., by whom it is held in high estimation. It produces well and ripens early.

The Kentucky white bearded, Hutchinson or Canadian flint is very popular in Western New-York where it has been rapidly disseminated since its first introduction some 12 years since. It is hardy, a good yielder, with a short plump berry, weighing 64 lbs. per bushel. It requires thicker sowing (about 25 per cent. more seed) than the improved flint, as it does not tiller as well, and unlike that it shells easily, wasting much unless cut quite early.

The English velvet beard or Crate wheat has a coarse straw, large heads, a good berry of a reddish hue, and is well adapted to the rich alluvial bottom lands, where its firm straw prevents its lodging. It is a fair yielder and tolerably hardy, but its long beard is a great objection to its introduction on such lands as are suited to the finer kinds.

The Yorkshire or English flint or Soules wheat has been recently introduced, and is similar in its leading features to the old Genesee.

The white Provence is a new and favorite variety, but its slender stalk frequently subjects it to lodging. It is only suited to the finest calcareous wheat soils.

The blue stem has been raised with great success in Union, Penn., where it resisted smut and rust when all other kinds in the vicinity were affected by it.

The Mediterranean is a coarse wheat with a thick skin, yielding a dark flour. It resists rust and the fly, is a good bearer, and may be profitably grown where other choice kinds fail.

The Egyptian, Smyrna, Reed, Many spiked, or Wild goose wheat is also a hardy variety, with a thick, heavy straw which prevents its lodging.

Production of new varieties of wheat.—Besides introducing valuable kinds from abroad and the improvement by careful cultivation of such as we now have, new varieties may be secured by hybridizing or crossing. This is done by impregnating the female organs of the flowers on one plant, by the pollen from the male organ of another. The progeny sometimes materially differs from both parents, and occasionally partakes of the leading qualities of each. Among those thus produced, some may be found of peculiar excellence and worthy of supplanting others whose value is declining. The effect of this crossing is striking in the ear of corn, where the red and white, the blue and yellow kernels are seen to blend in singular confusion over the whole ear, each differing too

in size, shape and general qualities. Observation will sometimes detect a new variety of wheat in the field, self hybridized, the result of an accidental cross. If this has superior merit, it should be carefully secured and planted in a bed by itself for future seed.

Propagation may be extended with incredible rapidity by dividing the plant. The English Philosophical Transactions give the result of a trial made by planting a single grain on the 2d of June; on the 8th of August it was taken up and separated into 18 parts and each planted by itself. These were subdivided and planted between 15th of September and 15th of October, and again the following spring. From this careful attention in a fertile soil, 500 plants were obtained, some containing 100 stalks bearing heads of a large size; and the total produce within the year was 386,840 grains from the single one planted.

Spring Wheat.—This requires a soil similar to that of winter grain, but it should be of a quick and kindly character as it has a much shorter time to mature. The ground should be well pulverized and fertile. The best crops are raised on land that has been plowed in the fall, and sown without additional plowing, taking care to harrow in thoroughly. When planted early, the wheat rarely suffers from the fly as it attains a size and vigor beyond the reach of injury before it appears. In certain localities where the fly abounds and the wheat has not been early sown, it is found necessary to keep back the young plants till the disappearance of the fly. Large crops have been obtained under favorable circumstances, when sown as late as the 20th May.

Varieties.—The *Black Sea Wheat* is one of the most popular kinds at present cultivated. Of this there are two varieties, the red and the white chaff, both of which are bearded. The former is generally preferred. This wheat has yielded very profitable crops. The *Siberian* is a valuable wheat, and has been much raised in this country. It produces a full, fine grain, is hardy and a good bearer. The *Italian* has been much cultivated, and held in high estimation, but it is now generally giving place to the preceding where each has been tried.

There are some other varieties which bear well and are tolerably hardy. Excellent spring grain has been produced by early sowing from choice winter wheat, which has retained most of the characteristics of the original under its

new summer culture. In large sections of this country wheat has been seriously injured by winter-killing and other casualties; and wherever these prevail and the soil is suited to it, summer wheat may be advantageously introduced. A proper attention to the selection of seed and the preparation of the soil will generally insure a profitable return. If its market value is not as high, it may at least afford all that the farmer and his laborers require; and he will generally find if not in a wheat-growing region, that he can dispose of his surplus crop among his neighbors before the next harvest comes round and at satisfactory prices.

R Y E (*Secale screale*)

Is extensively cultivated in the northeastern and middle Atlantic states. It is grown on the light lands of Ohio and Michigan, and as the supporting elements of wheat become exhausted in the soil of the rich agricultural states of the west, it will take its place in a great measure on their lighter soils. Most of the Eastern and Atlantic states when first subjected to cultivation, produced wheat; but where lime did not exist in the soil the wheat crop soon failed, and it has gradually receded from the Atlantic border, except in marly or calcareous soils or those that were reclaimed by a plentiful addition of lime, rye almost universally succeeding it. But the liberal use of lime with the agriculteral improvements of the present day are regaining for wheat much of its ancient territory.

Rye resembles wheat in its bread-making properties, and for this purpose is only second to it in those countries where it is cultivated. There is a peculiar aroma attached to the husk of the grain, which is not found in the finely bolted flour. The grain when ground and unbolted is much used in the New-England states for mixing into loaves with scalded Indian meal; it is then baked for a long time and is known as *rye-and-Indian* or *brown bread.* This possesses a sweetness and flavor peculiar to itself, which is doubtless owing in no small degree to the quality above mentioned. Von Thaer says "this substance appears to facilitate digestion and has a singularly strengthening, refreshing and beneficial effect on the animal frame," Rye is more hardy than wheat and is a substitute for it on those soils which will not grow the latter grain with certainty and profit.

Soil and Cultivation.—Neither strong clay or calcareous lands are well suited to it. A rich sandy loam is the

natural soil for rye, though it grows freely on light sands and gravels which refuse to produce either wheat, barley or oats. Loamy soils that are too rich for wheat and on which it almost invariably lodges, will frequently raise an excellent crop of rye, its stronger stem enabling it to sustain itself under its luxuriant growth.

The Preparation of the Soil for Rye, is similar to that for wheat; and it may be advantageously sown upon a rich old turf or clover ley, or after corn or roots where the land has been well manured and thoroughly cleansed from weeds. There is not an equal necessity for using a brine-steep for rye as for wheat, yet if allowed to remain a few hours in a weak solution of saltpetre or some of the other salts, it promotes speedy germination and subsequent growth.

Sowing.—There is but one species of rye, but to this cultivation has given two varieties, the spring and winter. Like wheat they are easily transformed into each other by sowing the winter continually later through successive generations to change it into spring grain, and the opposite for its re-conversion into winter grain. The last should be sown from the 20th of August to the 20th of September, the earliest requiring less seed, as it has a longer time to tiller and fill up the ground. Five pecks is the usual quantity sown, but it varies from one to two bushels according to the quality of the soil, the richest lands demanding most. It is a practice among many farmers to sow rye among their standing corn on light lands, hoeing it in and leaving the ground as level as possble. On such lands this is attended with several advantages, as it gives the grain an early start and a moist, sheltered position, at a time when drought and a hot sun would check or prevent vegetation. As soon as the corn is sufficiently matured, it should be cut up by the roots and placed in compact shocks, or removed to one side of the field, when the rye should be thoroughly rolled. When sown on a fresh plowed field, it should be harrowed in before rolling. Great success has attended the turning in of green crops and following the fresh plowing with instant sowing of the seed. This brings it forward at once. No after cultivation is needed except harrowing in spring and again rolling if the land is light, both of which are beneficial, for though some of the stools may be thus destroyed, the working of the ground assists the remaining plants so as to leave a great advantage in favor of the practice. A friend of the writer had occasion to plow some land in the spring which joined a field of rye belonging to a

neighbor. The owner claimed damages for supposed injury by the team and plow, which it was agreed should be assessed on examination after harvesting, when it appeared, that the *damaged* part was the best of the whole field. An honest English yeoman received several pounds from a liberal squire, for alleged injury to his young grain from the trampling of horses and hounds in hot chase after a fox ; but at harvest he found the crop so much benefitted by the operation that he voluntarily returned the money. If the rye is luxuriant, it may be fed both in the fall and spring. Early cutting as in wheat produces more weight, larger measure and whiter flour. What is intended for seed, must however be allowed to ripen fully on the ground.

DISEASES.—Rye is subject to fewer casualties than wheat. *Ergot or cockspur* frequently affects it. This fungus is discovered not only on rye, but on other plants of the order graminæ. Several of these elongated, curved and brownish spurs appear on a single head, and they are most frequent in hot, wet seasons. They are poisonous both to man and beast, and when eaten freely they have generated fatal epidemics in the community; and emaciation, debility and in some cases death to animals consuming it. The sloughing of the hoofs and horns of cattle has been attributed to ergot in their grass and grain. *Rust* like that which affects the wheat crop, and owing probably to the same causes, attacks rye. When this happens it should be cut and harvested without delay.

Rye for Soiling is sometimes sown by those who wish late forage in autumn and early in spring. For this purpose it should be sown at the rate of 2 to 4 bushels per acre. If on a fertile soil and not too closely pastured, it will bear a good crop of grain; and in some cases when too rank, early feeding will strengthen the stalk and increase the grain.

BARLEY (*Hordeum*)

Is a grain of extensive cultivation and great value. Like wheat and rye, it is both a winter and spring grain, though in this country it is almost universally sown in the spring. There are six varieties, differing in no essential points and all originating from the same source. Loudon says in choosing for seed, " the best is that which is free from blackness at the tail, and is of a pale lively yellow, intermixed with a bright whitish cast; and if the rind be a little shrivelled so much the better, as it indicates thin skin. The husk of thick-rinded

barley is too stiff to shrink and will lie smooth and hollow even when the flour is shrunk within. The necessity of a change of seed from time to time, for that grown in a different soil, is in no instance more evident than in this grain, which otherwise becomes coarser every successive year. But in this as in all other grain, the utmost care should be taken that the seed is full bodied."

The principal varieties are the two and six rowed; the last being preferred for hardiness and productiveness in Europe, and the first generally cultivated in this country for its superior fulness and freedom from smut. There are numerous sub-varieties, such as the Hudson's Bay which ripens very early and bears abundantly; the Chevalier and Providence, both accidental, of which a single stalk was first discovered among others of the ordinary kinds, and proving superior and of luxuriant growth, they were widely propagated; the Peruvian, Egyptian, &c. New varieties may be produced by crossing, as with wheat.

Soil.—Barley requires a lighter soil than will grow good wheat, and a heavier than will grow tolerable rye; but in all cases it must be one that is well drained. A mellow rich loam, ranging between light sand or gravel and heavy clay, is best suited to it.

Cultivation.—It may be sown as soon as the ground is sufficiently dry in spring, on a grass or clover ley turned over the preceding fall; or it may follow a well manured and cleanly hoed crop. If sown on a sod it should be lightly plowed in, but not so deep as to disturb it, and afterwards harrowed or rolled. The soil should always be well pulverized. From 1½ to 2½ bushels per acre is the usual allowance of seed, poor and mellow soils, and early sown, requiring the least. Barley should never follow the other white grains, nor should they succeed each other unless upon very rich soil. No farmer can long depart from this rule without serious detriment to his soil and crops. Barnyard manures should not be applied directly to this grain unless it be a light dressing of compost on indifferent soils; or in moderate quantity after the plants have commenced growing in spring. When the plants are 4 or 5 inches high, rolling will be of service if the ground is dry and not compact. This operation gives support to the roots, destroys insects, multiplies seed stalks and increases their vigor.

Destroying weeds in grain.—When grain is infested with cockle, wild mustard or other weeds, they should be extirpa-

ted by hand before they are fairly in blossom. If neglected till sometime after this, the seed is so well matured as to ripen after pulling, and if then thrown upon the ground they will defeat the effort for their removal. When too luxuriant, barley like rye may be fed off for a few days, but not too closely.

THE HARVESTING of barley should be seasonably done or its extreme liability to shell will cause much waste, and on the contrary, it will shrivel if cut before fully matured. It may be stacked like wheat.

THE USES OF BARLEY are various and important. In Europe it forms no inconsiderable part of the food of the inhabitants. The grain yields from 80 to 86 per cent. of flour, which however contains but 6 per cent. of gluten; 7 per cent. being sacharine matter and 79 mucilage or starch. It is inferior in nutriment to wheat and rye but superior to oats. In this country it is principally used for malting and brewing and in some cases for distilling, but when ground is more generally appropriated to fattening swine, though sometimes used for other stock.

THE OAT (*Avena sativa*)

Is cultivated throughout a wide range of latitude and on a greater variety of soil than any other grain. It will grow on rich or poor, and on dry or moist soils; on the heaviest clays and the lightest sands, and it will pay as well on rich lands as any other crop. The average yield on good soils is from 30 to 40 bushels per acre, and on the richest when well cultivated, it has exceeded 120 bushels. It is exposed to fewer injuries than other grain, being seldom affected by rust, smut or insects. The wire-worm is most destructive to it, especially when sown on fresh sod. The most effectual mode of extirpating these and other troublesome insects is to turn the sod over late in the fall just before our severe winter frosts. They thus become chilled and incapable of seeking a safe retreat from their fatal effects. If not plowed at that time, it should be done immediately before sowing in spring, when by turning them into the bottom of the furrow, they cannot find their way to the surface in sufficient numbers to prey upon the plant before it gets beyond the reach of their attacks.

VARIETIES. Of these, Loudon mentions nine as being well defined and entirely distinct, besides which there are many local or recent sub-varietes. He says "*The White or*

common oat is in most general cultivation in England and Scotland and is known by its white husk and kernel. *The Black oat* known by its black husk and cultivated on poor soils in the north of England and Scotland. *The Red oat* known by its brownish red husk, thinner and more flexible stem and firmly attached grains. It is early, suffers little from winds, meals well, and suits windy situations and a late climate. *The Poland oat*, known by its thick white husk, awnless chaff, solitary grains, short white kernel, and short stiff straw. It requires a dry warm soil but is very prolific. *The black Poland oat* is one of the best varieties; it sometimes weighs 50 lbs to the bushel. *The Friezland or Dutch oat* has plump thin skinned white grains mostly double, and the large ones sometimes awned. It has longer straw than the Poland, but in other respects resembles it. *The Potato oat* has large, plump, rather thick skinned, white grains, double and treble, with longer straw than either of the two last. It is now almost the only kind raised in the north of England and the south of Scotland, and brings a higher price in the London market than any other variety. They have all been derived from the produce of a single stalk which was first discovered growing in a field of potatoes in England, in 1788. *The Georgian oat* is a large grained, remarkably profitable variety and on rich soil, in good tilth has produced more than any other variety. *The Siberian or Tartarian* is by some conceded a distinct species. The grains are black or brown, thin and small and turned mostly to one side of the panicle and the straw is coarse and reedy. It is little cultivated in England, but is found very suitable for poor soils and exposed situations. *The winter oat* is sown at the rate of 2 bushels per acre in October, the plants are luxuriant and tiller well, and afford good winter and spring pasture for ewes and lambs, and when these are shut out, it affords an ample crop of grain in August."

The Hopetown oat originated from a single stalk that was first discovered in 1824, by Mr. Sherriff, in a field of potato oats. It is distinguished by its exceeding height, and superior produce when sown on rich soils. *The Dyock oat* is a recent sub-variety of the Potato oat, and it is claimed for it that it exceeds the last in the number of bushels yielded per acre, and also in the weight of the grain and the quantity of meal. *The Skinless oats*, much commended in Ireland, have been tried in this country without much success. They have shown a tendency to degenerate, the necessary effect

of previous highly artificial cultivation. There are many other varieties which have a partial or local popularity, and from the readiness with which new kinds are produced, careful attention and observation on the part of the farmer, will detect from time to time such as may have a decided value over others for particular localities. A superior kind was discovered in a field of common oats in Oneida County, N.Y. some years since, and from the produce of one stool it became widely disseminated and has uniformly proved both hardy and prolific. The variety most cultivated in the United States, is the common white, which is hardy and a good bearer, weighing from 32 to 35 lbs per bushel. The black oat is preferred in western N. Y. and some other sections of the country. Repeated trials have been made with the potato oat, a heavy grain weighing from 35 to 45 lbs per bushel, but its merits have not proved conspicuous enough to have given it the place of the old and long tried varieties in the United States.

Cultivation.—In this country oats are sown at the rate of 2 to 4 bushels per acre during all the spring months and sometimes, though rarely, in June. The earliest sown are usually the heaviest and most productive. They may occupy a turf or follow any of the well-manured hoed crops as mentioned in the preceding grain. No apparent advantage has been derived from steeps for the prevention of smut as in wheat, the impervious husk of the oat apparently arresting the liquid and preventing its penetration to the kernel. Sowing salt broadcast over the land at the rate of 2 to 6 bushels per acre has been found of use to the crop, both in furnishing it with a necessary manure and by killing insects. The seed should be well harrowed in and rolled and no after attention is required except to destroy the prominent weeds.

Harvesting.—Oats frequently ripen unevenly and if there is a large proportion of such as are backward, the proper time for cutting will be as soon as the grain in the latest may be rubbed out of the straw by hand. The oat is sufficiently matured for harvesting after it has passed the milk state, and is easily compressed between the thumb and finger. The lower part of the stalk will then have assumed a yellow color and it ceases to draw nutriment from the soil. If cut at this time the straw is better for fodder and for other uses; the grain is fuller; the husk lighter; and the loss from shelling, which is frequently a great item when left too late, is avoided. Oats when very tall are most profitably cut with the sickle,

and when lodged, with the scythe; but when erect and of medium height, with the cradle, which is by far the most speedy and economical, and this leaves them in a suitable position for binding into sheaves. They may be stacked like wheat.

THE USES of oats are various and differ materially in different countries. In Scotland, Ireland, and many other countries, oat meal is much used as human food and for this the potato oat, or some one of the heavy kinds is preferred, as they afford a larger proportion of meal and less of husk. Scotland, "the land o' cakes" draws no inconsiderable part of the support of her entire laboring population from this meal, which is formed into small thin cakes and eaten with milk, butter, &c., or it is mixed with water or milk and made into a kind of pudding under the name of *stirabout*, a favorite dish, which is said to be palatable to those accustomed to it.

Davy found in 1000 parts of Scotch oats, 743 of soluble or nutritive matter, containing 641 of mucilage or starch, 15 saccharine matter, and 87 gluten or albumen. Those of England, gave 59 of starch, 6 of gluten, 2 of saccharine matter, and 33 of husk in 100 parts. They are but little used for human food in this country, and this is principally by emigrants who bring their early habits with them. They are prepared by kiln-drying and hulling, then grinding and bolting when required to separate the flour. The meal is scalded before using and mixed with about half its weight of wheat flour when made into bread. It is sold by the apothecaries to invalids for whom it is valuable on account of its light, digestible character. It is also stirred into water, making an excellent beverage for laborers in hot weather. The principal use of oats however, in the United States, is as food for working animals, for which it is unrivalled. Oats are sometimes used when ground, for fattening cattle, sheep and swine, but for this purpose they are far surpassed by corn, barley, peas or boiled potatoes. They are an excellent fodder for stock sheep and for them are most economically fed in the straw.

INDIAN CORN, (*Zea maize*).

This next to the grasses, is by far the most important crop of the United States. The census returns for 1840, gave 387,000,000 bushels; and for 1843 the estimate of the whole product of Indian corn in this country was over 494,000,000 bushels. The effect of this immense production of

a staple article is felt in every department of our agriculture; and is conclusively shown by the low prices of beef, pork, mutton, human food, whiskey and highwines, to all of which corn is made largely to contribute. Nearly all the beef and pork of the vast and fertile west, and much in the north and south is fed upon it. Corn seems to have been created for this western hemisphere. It is raised in boundless luxuriance from the frozen regions of Canada, almost to the Straits of Magellan. It riots in the fierce blaze of our cloudless western sun, and it is here that it attains the highest perfection. Its most prolific area on this continent lies between 40° North and 38° South latitude, deducting a limited portion of the equatorial regions. Close attention in its cultivation is necessary when receding from these limits towards the poles on account of a deficiency of sun for ripening it. In such localities, the smaller and earlier kinds should be planted on a warm soil so as to mature before the first frosts.

VARIETIES.—There is no one of the cereal grains or grasses which manifests itself under such multiplied forms as maize. From the little shrubby stalk that grows on the shores of Lake Superior to the palmetto-like corn of the Miami Valley, and from the tiny ears and flattened, closely clinging grains of the former, the brilliant rounded little pearl, or the thickly wedged rice corn, to the magnificently elongated, swelling ear of the Kentucky, with its deeply indented gourd seed, it is developed in every grade of sub-variety. The kernels are long, round, or flat, and are white, yellow, blue, red or striated; but each contain the same principles of nutriment combined in somewhat different proportions, and contributes for equal weights, nearly in the same ratio to the support of man and the lower order of the animal creation. The analysis of corn as given by Dr. Dana, is in 100 parts, of

Flesh forming principles, (gluten and albumen)	12·60
Fat forming, (gum, sugar, starch, oil, woody fibre,)	77·09
Salts,	1·31
Water,	9
	100

Besides the kinds in general cultivation in this country, varieties have been occasionally introduced from abroad, of a character so different as almost to entitle them to the distinction of independent species. Such are the Chinese tree corn, bearing its slender ears at the extremity of several expanded branches; the Egyptian with its millet-like head; the Ore-

gon with its separate husk or envelope for every distinct kernel. But if we narrowly watch the vagaries of nature, we shall notice deviations from the matter of fact standards of our domesticated varieties, which approximate so closely to the most fanciful of the exotics, that we are compelled to believe that all those which have hitherto come within our notice, originated from one common head; and that all the peculiarities are owing to the difference of soil, climate and culture, and the carefully cherished eccentricities of nature, aided by a skilful science or well practised art. It is needless to particularise the many popular kinds of corn under successful cultivation in this country. They are found to vary with almost every degree of latitude and longitude; and there are not unfrequently numerous kinds held in deservedly high estimation within a single district. From these there will be no difficulty in selecting such as will best repay the farmer's attention.

THE SOIL for corn must be dry, rich and well pulverized. Neither strong clay, wet or poor lands will yield good crops of corn. Land can scarcely be too rich for it, and the fresher and less fermented the manure applied to it is, unless on light sandy soils, the better it will be for the crop. A great error is committed in raising corn as with most of our tillage crops, from not having the soil sufficiently enriched; though this error is diminished in the case of such as will not bear an excess of manure. Corn is a gross feeder and necessarily ranges over a great space in search of food. It has a large amount of stalk, leaves and grain to provide for in a few weeks, and its increase will be commensurate with the supply of food.

A clover ley or rich grass sod is an excellent preparation for corn, with the addition of manure when required. But the manure should always be scattered broadcast, plowed and well harrowed in. The roots will be certain to find it and in consequence of its general diffusion, the development of the ear and grain will correspond with that of the stalk and leaves. When manured in the hill on poor soil, it comes forward early, and this induces an extension of the roots, which finding little support, the crop is limited to the stalks and leaves and a small proportion of grain.

THE SELECTION OF SEED should be made with the utmost care, not only from the best varieties, but the best seed of the particular kind desired. Some of the choicest have been brought to their present perfection by selecting only the ear-

liest and largest ears from the most prolific stalks. This ought always to be done before the corn is gathered in the field where there is an opportunity for comparison.

PREPARATION OF SEED.—Repeated experiments have demonstrated the great utility of steeping corn for 24 to 48 hours before planting, in a solution of saltpetre. This accelerates the growth of the plant, and is a protection against birds, squirrels and mice, and for a while it will keep off worms. An effectual remedy against these depredations is to add half a pint of boiling tar to a peck of seed, stirring the corn briskly for several minutes as the tar is added, till every kernel is thinly coated with it. This supercedes the necessity of the worse than absurd remedy of scare scrows. The crows and other birds are of great advantage to the farmer on all his fields as they pick up numberless insects, grubs and worms which infest the ground and destroy or seriously injure the vegetation.

PLANTING.—Corn may be planted in hills from 3 1-2 to 4 1-2 feet assunder, and with from 3 to 5 stalks well spread in each hill, according to the kind of seed, quality of land, &c. Some plant in drills, but this is objectionable as the trouble of cultivation is greater without increasing the yield. Thick planting gives fewer ears upon a stalk and those of less size. The time of planting at the North is usually within the three first weeks of May, depending much on the season. Late frosts will sometimes cut down the first leaves without destroying the germ, but it is always best to defer planting till all apprehensions of it are removed. In the more Southern States earlier planting is desirable, and it is there put into the ground in March and April. To give regularity to the rows and facilitate after culture, the furrows for the seed should be struck out each way with the utmost exactness, and twice the corn planted that is required to remain. It should be covered about 2 inches. The surplus plants can be pulled up at the second hoeing when all fear of injury is past. If the land is light, it should be laid flat before planting and after this, it should be thoroughly rolled.

CULTIVATION.—The ground may be stirred when the plants first show themselves. This is most economically done with the cultivator or light plow, and if the operation be frequent and thorough there will be little use for the hoe. Hilling or heaping the earth around the plants should always be avoided except with very heavy soil or such as is liable to an excess of moisture; in all other cases it should remain

flat. Stirring the gronnd in dry weather is peculiarly beneficial to corn and all hoed crops. Some omit it then from fear of the escape of moisture, but its effect is precisely the reverse, as nothing so certainly produces lightness, porosity and unevenness in the soil, which under the head of soils and draining, we have shown facilitated the admission and escape of heat, that inevitably secures the deposit of large quantities of moisture, even in the driest and most sultry weather. Corn and other crops, which were withering from excessive drought, have been at once rescued from its effects by a thorough use of the plow and cultivator. Well drained, dark colored and rich porous soils will be found to suffer much less in drought than others which lack these characteristics.

Harvesting.—If there be no danger of early frost, the corn may be suffered to stand till fully ripe; though if the stalks are designed for fodder, they are better to be cut when the grain is well glazed, and this should be done in all cases where frost is expected. Scarcely any injury occurs either to the leaf or grain if the corn be stooked, when both would be seriously damaged from the same exposure if standing. The stalks of corn should never be cut above the ear, but always near the ground, and for this obvious reason. The sap which nourishes the grain is drawn from the earth, and passing through the stem enters the leaf, where a change is effected analogous to what takes place in the blood when brought to the surface of the lungs in the animal system; with this peculiar difference however, that while the blood gives out carbon and absorbs oxygen, plants under the influence of light and heat, give out oxygen and absorb carbon. This change prepares the sap for condensation and conversion into the grain. But the leaves which thus digest the food for the grain are above it, for it is while passing downward that the change of the sap into grain principally takes place. If the stalk be cut above the ear nourishment is at an end. It may then become firm and dry but it is not increased in quantity, while if cut near the root, it not only appropriates the sap already in the plant, but it also absorbs additional matter from the atmosphere which contributes to its weight and perfection. It must be perfectly dried in the field, and after this husked and carried into an airy loft or stored in latticed or open barracks. The stalks may be housed or carefully stacked for fodder. Many of our Western farmers allow both grain and stalks to stand in the field till wanted for use, when they are fed in an adjoining enclosure. This is

more economically done by first cutting (or what is better, by both cutting and *grinding*, which may be accomplished by a recently invented machine,) and then mixed either with roots or meal. When fodder is high, the stalks and leaves will repay the expense of cultivation.

CORN FOR SOILING.—Corn has recently been much cultivated for fodder, and for this purpose the soil should be in high condition and well pulverized. It should be prepared in a pickle of salt petre like that intended for ripening, and may be sown broadcast and harrowed in at the rate of 3 or 4 bushels per acre. A much better method is to sow thickly in drills, and stir the ground with a light plow or cultivator. The sowing may be done early or late, though the first is most successful. It should be cut before the frosts touch it, and dried previous to housing. Several tons of excellent forage have been raised from a single acre. In the report of Mr. Leak to the Pedee Agricultural Society of South Carolina, it is asserted that 138,816 lbs. of green corn stalks have been cut from one acre in a season, weighing when dry, 27,297 lbs.

THE USES OF CORN in this country are various. It is largely fed to fattening and working animals, but must be judiciously fed to the latter and only in cool weather. It is extensively manufactured into high-wines and whiskey, (a sad perversion of one of the best gifts of nature.) It is converted into oil, molasses and sugar to a very limited extent, and is variously and largely applied to domestic uses. While green it is boiled and roasted in the ear; or it is cut from the cob and cooked with the garden or kidney bean, which forms the Indian *succotash*. When ripe, it is hulled in a weak ley, then boiled and known as *hulled corn*; or parched over a hot fire, affording a delicious lunch and a convenient provision for hunters as *popped corn*. *Hommony or samp*, is a favorite dish, and consists of corn coarsely ground and boiled in water; and *hasty pudding* differs from this in being made of fine meal. The meal may be compounded with milk and eggs into *jonny cakes*, puddings, griddles and other delicacies universally esteemed for the table.

RICE (*Oryza sativa.*)

Contributes directly to the support of a larger number of the human family than any other plant. In China, and nearly the whole length of the southern part of Asia, through the innumerable and densely populated islands of the Pacific and Indian Oceans, in the southern part of Europe, and a large

extent of Africa, and through no inconsiderable portion of the North and South American continent, it is extensively grown, and forms the staple food of the inhabitants. Rice requires a moist soil, and is much more productive when subject to inundation. A hot sun is also necessary to mature it, and as a result of these two essential conditions, its culture is limited to regions much more circumscribed than are allotted to wheat, maize, or some of the usually cultivated plants. We subjoin from the American Agriculturist, an excellent article on the cultivation of rice, from the pen of Dr. Cartwright.

"There are many varieties of rice; but I am induced to believe that they are all essentially aquatic. All the varieties, yet discovered, flourish best under the inundation system of culture; yield more to the acre, give less trouble, and require less labor. Nevertheless, each variety grows pretty well on light, moist uplands without irrigation, when cultivated with the hoe or plow. The product, however, is so much less than by the irrigation system, and the labor of tillage so much more, that the upland producer never can compete successfully with the lowlander. The former may curtail his expenses by growing rice for domestic uses, but he can not, very profitably, produce it for sale. Besides the ten-fold labor, which rice on upland requires, in comparison to that cultivated by the irrigation system, it can not be sown thick enough to make a larger yield per acre. Space must be left for the plow or hoe to till the rice, which is not necessary in those localities where it can be overflowed at will, and the water drawn off as occasion may require.

"The method pursued on the rice lands of the lower Mississippi, is to sow the rice broadcast, about as thick as you sow wheat at the north, and harrow it in with a light harrow having many teeth; the ground being first well plowed and prepared by ditches and embankments for inundation at will. It is generally sown in March. Immediately after sowing, the water is let on, so as barely to overflow the ground. The water is withdrawn on the second, third, or fourth day, or as soon as the grain begins to swell. The rice very soon after comes up and grows finely. When it has attained about three inches in height, the water is again let on; the top leaves being left a little above the water. Complete immersion would kill the plant. A fortnight previous to harvest, the water is drawn off to give the stalks strength, and to dry the ground for the convenience of the reapers.

"A different method is practised in the northern part of Italy. The seed is sown in April; previously to which it is soaked a day or two in water. After sowing, about two inches of water is let in upon the ground. The rice comes up through the water, which is then drawn off to give the plant strength, and after some days, is again let on. The rice is more apt to mildew under this practice, than our method of letting the water on about the time the Italians draw it off.

"The same measure of ground yields three times as much rice as as wheat. The only labor, after sowing, is to see that the rice is properly irrigated, except in some localities where aquatic plants prove troublesome, the water effectually destroying all others.

"The rice-grounds of the lower Mississippi produce about seventy-five dollars worth of rice per acre. The variety called the Creole white rice is considered to be the best. In the eastern part of the State of Mississippi, called the '*piney woods*,' rice is very generally cultivated on the uplands. Although it can not be made a profitable article of export, yet it affords the people of that interior region an abundant supply of a healthy and nutritious food for themselves, and a good provender for their cattle, and makes them independent of the foreign market. Unlike other kinds of grain, it can be kept for many years without spoiling, in a warm climate, by simply winnowing it semi-annually, which prevents the weevil and a small black insect that sometimes attacks it. It is cultivated entirely with the plow and harrow, and grows well on the pine barrens. A bull-tongued plow, a kind of shovel plow drawn by one horse, is driven through the unbroken pine-forest; not a tree being cut or belted, and no grubbing being necessary, as there is little or no undergrowth. The plow makes a shallow furrow about an inch or two deep, the furrows about three feet apart. The rice is dropped into them and covered with a harrow. The middles, or spaces between the furrows, are not broken up until the rice attains several inches in height. One or two plowings suffice in the piney woods for its cultivation—weeds and grass, owing to the nature of the soil, not being troublesome. A similar method of cultivation obtains on the prairie land of the north-western states.

"Rice, like hemp, does not impoverish the soil. On the contrary, it is a good preparatory crop for some others, as Indian corn. The pine barrens of Mississlppi would produce rice

ad infinitum, if it were not that the land, after a few years, owing to the sandy nature of the soil, becomes too dry for it. It has been ascertained by Arnal, that 12 pounds of wheat flour and 2 pounds of rice will make 24 pounds of an excel lent bread, very white and good; whereas, without the addition of rice, 14 pounds of flour will only make 18 pounds of bread. Like other kinds of grain, rice adapts itself to the soil and climate, and particular mode of cultivation; but if the seed be not changed, or selected from the best specimens of the plant, it will ultimately degenerate. Thus in Piedmont, after a long series of years, the rice became so much affected with a kind of blight called the *brusone*, as to compel the Piedmontese to import fresh seed in 1829, from South Carolina. The American rice introduced into Piedmont escaped the *brusone*, but it was several years before it adapted itself to the soil and climate. Some years ago, a French traveller by the name of Poivre, finding rice growing in great perfection on the mountains and highlands of Asia, particularly Cochin China, named it '*riz sec*' or dry rice, and sent the seed to Europe, where many experiments were made with it. It yielded no better than any other kind of rice, and was found like all others to succeed best when inundated. The reason why it yielded so much more in Asia than in Europe, can be readily accounted for, by the natural inundations it receives from the excessive rains during the monsoons.

"No variety has been discovered which yields as much out of the water as it does in it. There are many localities in the United States, where the culture of rice by the irrigating system, would rather serve to make the surrounding neighborhoods healthy instead of sickly. It is generally admitted, that a given surface of ground completely inundated, is much less unhealthy than the same surface partially inundated, or *in transitu* between the wet and the dry state. Hence mill-ponds which partially dry up in the summer, are fruitful sources of disease. Some of the best rice is said to grow on the bottom of mill-ponds. Nothing more is necessary, than to make the bottom of the mill-pond perfectly level, and then to overflow the whole surface just deep enough to keep the top leaves above water. As if to show, that unhealthiness is not necessarily connected with the culture of this valuable grain, nature has imposed a law upon it, ordering that it should flourish better when overflowed with pure running water than with the stagnant waters of impure lakes and marshes.

"There are two kinds of rice, which are said to succeed best on uplands; the long and the round. The former has a red chaff, and is very difficult to beat. The latter shakes out, if not cut as soon as ripe. They nevertheless succeed best under the inundation system of culture. In the eastern hemisphere, rice is cultivated as far north as the 46th degree of latitude. The climate of the United States is better suited to it than that of Enrope, because our summers are hotter. In the northern part of China the variety called the imperial rice, or *riz sec de la Chine* (the *oriza sativa mutica*), is more precocious than any other, is said to yield a heavy harvest, and to constitute the principal food for the people of that populous region. But it has succeeded no better in Europe than any other kind of rice.

"The best rice lands of South Carolina are valued at five hundred dollars per acre, while the best cotton-lands sell for a tenth part of that sum, proving that rice is more profitable than cotton. The profits of a crop should not so much be estimated by the yield per acre, as the number of acres a laborer can till. After the land is properly prepared for inundation, by levelling, ditching, and embankments, a single individual can grow almost an indefinite quantity of rice. Rice is no doubt ultimately destined to supersede cotton in a large portion of Mississippi and Louisiana."

MILLET (*Panicum milliaceum*)

In it growth and the manner of bearing its seeds, the millet strongly resembles a miniature broom corn. It grows to the height of 2½ to 4 feet with a profusion of stalks and leaves which furnish excellent forage for cattle. From 80 to 100 bushels of seed per acre have been raised, and with straw equivalent to 1½ or 2 tons of hay, but an average crop may be estimated at about one third this quantity. Owing to the great waste during the ripening of the seed, from the shelling of the earliest of it before the last is matured, and the frequent depredations of birds which are very fond of it, millet is more profitably cut when the first seeds have began to ripen, and harvested for fodder. It is cured like hay, and on good land yields from 2½ to 4 tons per acre. All cattle relish it, and experience has shown it to be fully equal to good hay.

Cultivation.—Millet requires a dry, rich and well pulverized soil. It will grow on thin soil, but best repays on the most fertile. It should be sown broadcast or in drills from the 1st May to 1st July. If for hay and sown broadcast, 40

quarts per acre will be required, if sown in drills for the grain, 8 quarts of seed will suffice. It will ripen in 60 to 75 days with favorable weather. When designed for fodder, the nearer it can approach to ripening, without waste in harvesting, the more valuable will be the crop.

BUCK WHEAT OR BEECH WHEAT (*Polygonum fagopyrum*)

Is a grain much cultivated in this country. It grows freely on light soils, but yields a remunerating crop only on those which are fertile. Fresh manure is injurious to this grain. Sandy loams are its favorite soils, especially such as have lain long in pasture, and these should be well plowed and harrowed. It may be sown from the 1st of May to the 10th of August, but in the northern states this ought to be done as early as June or July or it may be injured by early frosts which are fatal to it. It is sown broadcast at the rate of three to six pecks per acre and harvested when the earliest seed is fully ripe. The plant often continues flowering after this, and when the early seed is blighted as is often the case, the plant may be left till these last have matured. As it is liable to heat, it should be placed in small stacks of two or three tons each, but it is better to thresh out the grain at once. If not perfectly dry, the straw may be stacked with layers of other straw and when well cured, it will be a valuable fodder for cattle. Sheep will feed and thrive as well on this straw as on good hay.

USES.—This grain is ground and bolted and the flour is much used for human consumption. Before grinding, the hull or outer covering is removed, and when thus prepared, the flour is as white and delicate in appearance as the best rye, it is equally light and digestible, and is scarcely inferior to wheat in its nutritive properties. The grain is used for fattening swine but is most profitable when mixed with corn. Poultry thrive upon it. Buckwheat was formerly employed as a fertilizer, but for this object it is inferior to the clovers in all cases where the soil is capable of sustaining them. Its rapid growth will insure the maturing and turning under of two crops in one season. There are other varieties than the one specified, but none of equal value for general cultivation in this country.

CHAPTER VIII.

LEGUMINOUS PLANTS.

THE PEA (*Pisum sativum.*)

The pea, the bean, the tare, vetch, lupine, the clovers, &c. are all embraced in the botanical order *Leguminosæ.* The pea is valuable for cultivation not only for the table, but for many of the domestic animals. It is much fed to swine, sheep and poultry. For the former, it should be soaked, boiled or ground. If land is adapted to it, few crops can be more profitably raised for their use. They ripen early, and when beginning to harden they may be fed with the vines, and the animals will masticate the whole and soon fatten.

The Soil.—The heaviest clays will bear good peas, but a calcareous or wheat soil is better. Strong lands produce the best crops, but these should be made so by manures previously applied, as the addition of such as are fresh increases the growth of haulm or straw and sometimes diminishes both the quantity and quality of the pea. When sown on a thin sward, the manure should be spread before plowing. A dressing of well rotted manure increases the crop and is a good preparation when intended to be followed by wheat.

Varieties.—Of these there are many. The earlier kinds are generally indifferent bearers and their cultivation is limited almost exclusively to the garden. Of those for field culture, the marrow-fat are preferred for good lands, and are a rich pea. The small yellow are perhaps the best for poorer soils. There is a very prolific *bush-pea* grown in Georgia, bearing pods six or seven inches long, which hang in clusters on a short upright stem. The pods are filled with a white pea, which is highly esteemed for the table, either green or dry. In that latitude they bear two or three crops in one season.

Cultivation.—Peas should have a clean fallow, or fresh, rich sod well harrowed. They are not affected by frosts

and may be sown as soon as the ground is dry. This will enable them to ripen in season to plow for wheat. They are very liable to attack from the pea-bug, which deposits its egg in the pea while in its green state where it hatches, and the worm by feeding on the pea, diminishes its weight nearly one-half. Here it remains through the winter and comes out as a bug the following season. To avoid this pest, some sow only such seed as has been kept over two years, while others sow as late as the 15th or 25th of May which delays the pea till after the period of its attacks, but this latter practice seldom gives a large crop. It may be killed by pouring boiling water upon the seed, stirring for a few minutes, and then draining it off. Peas are sometimes sown in drills, but most usually broadcast, at the rate of two or three bushels per acre. It is better to plow them in to the depth of three inches and afterwards roll the ground smooth to facilitate gathering. When sown in drills they may be worked by the cultivator soon after coming up. The growth is promoted by steeping the seed for twenty or thirty hours in urine and then rolling it in ashes or plaster.

HARVESTING is accomplished by cutting with the sickle or scythe, or what is more expeditious, (when fully ripe so that the roots pull out easily) with the horse rake. When thus gathered into heaps and well dried, they may be threshed out and the haulm carefully stacked and saved for sheep fodder. If this is secured in good condition, cattle and sheep will do well upon it. Peas are frequently sown with oats and when thus grown, they be fed to sheep or horses unground, or made into meal for swine.

THE COW PEA.—This is grown in the Southern states, and is valuable either as a fertilizer or as food for domestic animals. Its long vines and succulent leaves which draw much of their substance from the air, and its rapid and luxuriant growth particularly adapt it to the first object, while its numerous and well filled pods and its great redundancy of stem and leaf afford large stores of forage. This is improved for cattle, when harvested before the seed is fully ripe. It is sown broadcast, in drills, or hoed in among corn, when the latter is well advanced. If in drills, it may be cultivated in its early stages by the plow, shovel-harrow or cultivator. It may be cut with the scythe, or drawn together with a heavy iron-toothed harrow or horse rake as with

the common pea. It requires a dry medium soil and is well suited to clays.

THE BEAN (*Phaseolus vulgaris.*)

The bean is often a field crop in this country and especially in the northern and middle states. It is principally used either green or dry for the table. It is a palatable and highly condensed food, containing much in a small compass. In proportion to its weight, it gives more nutriment than any of the ordinary vegetables; according to Einhof, yielding 84 per cent. of nutritive matter while wheat gives only 74. It has in common with the pea, vetch, &c., though in a greater proportion, a peculiar principle termed *legumin* which is analogous to *casein*, the animal principle in milk, which is convertible into cheese, and in its nutritive properties it is essentially the same as the *fibrin* of lean meat, the *albumen* of eggs and other animal matters. There is no vegetable we produce so fitted to supply the place of animal food as the bean.

Soil.—The bean is partial to a quick dry soil, too great strength or fresh manuring giving a large quantity of vine without a corresponding quantity of fruit.

Cultivation.—The land should be finely pulverized and if at all inclined to wet it should be ridged. Beans are tender plants and will not bear the slightest frost, and as they grow rapidly, they will be sure to ripen if planted when this is no longer to be apprehended. The seed is exposed to rot if put into the ground in a cold wet time, and the land should therefore be previously well warmed by the sun. The bush beans are the only kind used for field planting, and of these there are several sub-varieties. The long garden beans, white, red or mottled, are great bearers, of fine quality and early maturing. Early ripening is important, when other crops are to succeed the same season. They are usually planted in hills about two feet apart, and also in drills covered two inches with fine earth. They have been sown broadcast on clean dry soils and produced largely. When planted in drills, from five to eight plants should be left in each according to their proximity, or if in drills they need about 1½ bushels of seed to the acre.

Harvesting.—When the beans are fully formed and there is any danger of frost, they should be at once secured,

but this scarcely affects them when they are gathered and thrown into heaps. If the ground is not wanted for other uses, they may stand till the latest pods assume a yellow color. They are pulled with ease when the plant is mature as the fibres of the root are by that time dead. This is more quickly accomplished with an iron hook-rake, or if the stalks are partially green they can be mown. The vines if not dry should remain for a while in small heaps and afterwards collected in larger piles around stakes set at convenient distances, with the roots in the centre and secured at the top by a wisp of straw ; and when well dried, they should be threshed, cleaned and spread till quite free from dampness. The straw or haulm is an excellent fodder for sheep and should be stacked for their use. Beans are one of the best kinds of winter food for sheep when fed in small quantities. Sixty bushels have been raised on an acre worth from $1 to $2 per bushel. Sheep are the only animal which eats them raw, but swine, cattle and poultry will thrive on them boiled.

THE ENGLISH FIELD BEAN (*Vicia faba*)

Is cultivated under many varieties in Europe and particularly in Great Britain, as a field crop for the use of horses and other animals. Among these are *the Windsor, the tick, the long pods and others.* Arthur Young prefers "the common little horse-bean as being more generally marketable." We have tried several of these varieties and although entirely successful, have found them less adapted to our climate and agriculture than the ordinary crops. They prefer strong clay or clay loam soils.

THE TARE, VETCH OR FITCH (*Vicia satira*)

Is an important field crop in Europe for its stem and leaves as animal food. It is hardy and productive and considered valuable for green fodder or soiling. There are two kinds, the winter and spring. It is partial to a clay, but grows indifferently on any rich soil which is not too dry. It is sown broadcast or in drills, but generally the former, on well pulverized lands and covered with the harrow, demanding no after attention but the extermination of weeds. They are most useful for soiling, but may be fed on the ground or cut for hay. Tares have hitherto been little grown in this country, but in certain soils and situations

they may be introduced as a substitute for clover, where from any cause the latter does not grow successfully. All domestic stock are fond of them.

THE PINDA OR GROUND PEA, *(Arachis hypogæa)*.

This is a legumen and is cultivated with profit in the southern states on light sandy lands, where it yields from 30 to even 80 bushels per acre, besides furnishing much haulm for forage. It is sown in drills 4 or 5 feet apart, and worked with a light plow or cultivator immediately after the plants show themselves above ground. They soon overspread the whole surface. When properly matured, the roots are loosened by a fork and pulled up by hand, and after curing are put under cover for winter's use. They contain a large quantity of oil, but in other respects, closely resemble the common pea and bean in their nutritive qualities. They are in high repute for their fattening qualities.

CHAPTER IX.

ROOTS.

THE POTATO, (*Solanum tuberosum*).

The potato is a native of the American Continent. It is found in a wild state both in Buenos Ayres and Chili, and was probably discovered in the same condition by the early settlers of North America. It was supposed to have been taken into Spain and Italy early in the 16th century by Spanish adventurers, as it was cultivated in those countries in 1550. In 1588 it was introduced into Vienna from Italy, and also into England probably as early as 1586, by the colonists of Virginia who were sent out by Sir Walter Raleigh. It was regarded in Europe at first as a delicacy; but not until within a comparatively recent period has it found its way in both continents, as an article of agricultural attention, and an almost indispensable food for man and beast. As an illustration of the neglect of the potato in this country as a field crop, the writer may mention that he once knew an extensive eastern farmer, who, late in the last century, had raised in one year 7 bushels of potatoes. After disposing of all that was wanted for his own and his neighbors consumption he had still a surplus left. A farmer on the same premises at the present day would deem 700 bushels a short crop.

Varieties.—These are almost illimitable. They differ in form from round to oblong, are flat and curved or kidney-shaped; they vary in size from the delicate lady-finger to the gigantic blue-nose; their exterior is rough or polished and of almost every hue, white, yellow, red, and almost black; and the surface is smooth and even with the eye scarcely discernible, or deeply indented with innumerable sunken eyes like the rohan and merino. The interior is equally diversified in color and is mealy, glutinous or watery, and sometimes pleasant and sometimes disagreeable to the taste. They likewise differ in ripening earlier or later, and in being

adapted in some of their varieties to almost every peculiarity of soil. New kinds are produced at pleasure by planting the seed found in the balls. The tubers obtained in this way will be small the first season, but with careful culture will be large enough the second year to determine their quality, when the best may be selected for propagation. The earliest are easily designated by the premature decay of the tops. The varieties may also be increased from the seed by hybridizing, or impregnating the pistils of one flower by the pollen taken from the flower of another, and in this way some of the best and most valuable kinds have been procured. Such as have no flowers are more productive of tubers, as there is no expenditure of vitality in forming the seed. They may be compelled to flower by removing the small tubers from the stalks as they form.

THE BEST SOIL for potatoes is a rich loam, neither too wet or too dry; but such as are cool and moist, as those of Maine, Nova Scotia and Ireland, especially if in rich fresh sod, give the best flavored potatoes and are the least liable to disease. A calcareous soil yields a good potato, and generally a sure crop, and when there is little lime in the soil it should be added. Salt, ashes and gypsum are excellent manures and in certain instances have astonishingly increased the product. Crushed bones also greatly improve a potato soil. Fresh manures will often unpleasantly affect the taste of the potato, and when necessary to apply it, it should be scattered broadcast and plowed in.

THE SEED chosen should be such as experience has decided is best adapted to the soil and the use for which they are to be appropriated. Some are careful to select the most mealy for the table, and plant those which give the greatest yield for their cattle. This is sometimes mistaken policy, as what are best for man are generally best for cattle; and although the farmer may get a much greater weight and bulk on a given quantity of land of one kind, it may still be inferior in fat and flesh-forming materials to those afforded by a smaller quantity. Thus of three varieties grown in Scotland in 1842, the *cups* gave 13 3-4 tons per acre, containing 2 9-10 tons of starch; the *red dons* yielded 14 1-4 tons and 1 5-10 of starch; the *white dons* 18 1-2 tons and 2 4-10 of starch, and the kidney has even given as much as 32 per cent. of starch.—(*Johnston.*) There is also a difference in the relative proportions of gluten. Of this last, the potato contains in its new and ripe state about 2 1-4 per cent., which dimin-

ishes by long keeping. It is important in this as in an infinite number of other practical matters in the economy of agriculture, to have agricultural laboratories of unquestionable reliability, where the errors of superficial observation may be detected, and where the real superiority of one product over another, and their variations induced by soils, manures and treatment may be established beyond the possibility of a doubt.

PLANTING.—To produce abundantly, potatoes require a fertile soil, and if not already sufficiently rich, manure should be spread on the surface before plowing. If a tough sod, it should be plowed the preceding fall, or if friable, it may be done just before planting; but in all cases the land should be put in such condition as to be perfectly loose and mellow. Hills are the most convenient for tillage, as they admit of more thorough stirring of the ground with the cultivator or plow. Medium size, uncut potatoes have been ascertained from numerous experiments to be the best for planting, but when seed is scarce, it is sometimes economical to divide them. Two potatoes should be placed in each hill, or if in drills, they should be planted singly 10 inches apart. The distance both of hills and drills must depend on the strength of the soil and the size of the tops, some varieties growing much larger than others. Cover with light mold to the depth of 4 or 6 inches, and if the soil be light leave the ground perfectly level; if cold, heavy or moist, let the hill be raised when finished. Subsoil plowing is a great help to potatoes. The sets cut from the seed-end give a much earlier crop than those from the root.

CULTIVATION.—When the plants first appear above the ground, run the plow through them and throw the earth over them 2 or 3 inches, and no injury results if the tops are partially or even entirely covered. The hoe is scarcely required except to destroy such weeds as may have escaped the plow. The ground should be several times stirred before the tops interfere with the operation, but never after they come into blossom. Enormous crops have been procured by top dressing with compost earth, well rotten chip manure, &c. soon after the plants make their appearance; this is carried to the field and spread from a light one horse cart, the wheels passing between the rows; but such results are due to the nicest cultivation and they would be equally attained by placing the land in the best condition before planting. There is

some gain to the crop, when the buds are plucked before they come to blossom.

Harvesting and Storing should not be commenced until the tops are mostly dead, as the tuber has not arrived at full maturity before this time. They may then be thrown out of the hills by a harrow, plow, or some hand implement. They ought not to be exposed to the sun for any length of time, but may dry on the surface in a cloudy day, or be gathered into small heaps with some of the tops spread over them, until freed from the surface moisture, when they may be stored. Those selected for seed, should be placed in small piles in the field, or in thin layers in a cool, dry place in the cellar where the air is excluded and no heating or injury can occur. Such as are intended for consumption may be put in dry bins or barrels in the store room, covered with straw and dry sand or loose earth to prevent the circulation of air, or buried in the field. Where convenient of access, a hole may be excavated in the north side of a hill, or under a shade in a porous soil. When first stored, the potatoes should be covered for a few days with a slight thatch of straw so arranged as to shed the rain. A partial sweating or heating soon takes place, which drives off some of the moisture, after which they may be lightly covered with earth and in this way they may remain till the commencement of severe frosts, when they should be effectually protected from frost and rain till wanted in the spring. A northern exposure or shade will shield them from any injurious effects of the sun on the approach of warm weather. If stored on level ground, a hole should be excavated for their reception, from 1 to 2 feet in depth and 4 to 5 in width and of any length required. The potatoes are then ridged up like the roof of a house, thatched and covered as previously described. A ditch lower than the base must encircle the heap when the soil consists of clay, from which an outlet conducts away all the water, as any left upon them will inevitably produce decay.

Diseases.—The potato has long been subject to the *curl.* From numerous experiments made in Scotland to avoid this disease, it has been found that seed from potatoes which were gathered before fully ripe gave a much better and surer crop. It would be well to try the experiment in this country where there is any deficiency of product from want of full and healthy developement. Potatoes are also affected by the *scab and grub*, against whose attacks there is no remedy unless in a change of seed and location. *The rot* has for

several years produced serious and increasing injury to the potato crop, in 1845, almost threatening starvation in Ireland and causing great loss and suffering in other countries. Its effects have also been extensively felt in the United States. Numerous and scientific examinations have been made on the subject. The proximate cause is supposed to be a fungus, but what are the reasons for its late rapid extension and the remedy for its ravages have not yet been satisfactorily ascertained.

Preventives of rot.—Under the following circumstances rot has not appeared when adjoining fields have been nearly destroyed by it. 1. By using unripe seed, or seed which has been exposed to the sun, light and air, and well dried for 10 days after digging, and afterwards stored in a dry place in small parcels where air is excluded till the moment of planting. 2. By the use of lime, some of which is placed in the hill and the potateos dusted with it, and also from the use of charcoal and salt, gypsum or other salts. 3. By the absence of fresh barn-yard manure, or if used, by adding largely of lime or saline manures. 4. The use of fresh sod which has long been untilled. This has been found more efficacious than any other preventive, although it has occasionally failed. The sod may be plowed in the fall, or it may be left till late in May or early in June, when it has a good coating of grass, and then turned under flat, and furrowed lightly to receive the seed without disturbing the sod. Or they may be planted by using a sharpened stake 3 inches in diameter, with a pin or shoulder 10 inches from the bottom, on which the foot may be placed for sinking the holes. These should be made between the furrow slices at the proper distance for drills, and a single potato placed in each which may be covered with the heel. 5. Sound early varieties, early planted, have also escaped. We have thus secured a good yield, almost wholly free from disease; and even those affected did not appear to communicate disease to others. It has also been found that some very late planted have escaped rot; and if it be an epidemic, it may be that both by early and late planting, the peculiar stage of vegetation when the fungus appears, is in a great measure avoided. But the investigations on this important subject are still in their infancy, and nothing has thus far been ascertained, which can be justly considered as having determined principles of universal application; yet it is to be hoped that the zeal, intelligence and general interest which are now combined for this object will ere long de-

tect what has hitherto evaded the severest scrutiny of scientific research.

Arresting the disease has in some instances been successful, by mowing off the tops when they are found defective. This practice would be injurious to healthy plants, but may be adopted, like that of cutting grain when struck by rust, if it will secure even a part of the crop. When disease appears in such as are dug, they should be carefully sorted and the sound ones well dried, then placed separately in layers and covered with ashes, burnt clay, or fine dry mold, which act as absorbents of moisture and prevent contagion from such as may be imperceptibly affected. They may also be cut in slices and dried, or crushed and the farinaceous part extracted. By this means the potato will be made to yield nearly all its nutriment. It is found that this disease affects the tissues (the nitrogenized or albumenous part) of the potato only; and for this reason, potatoes which have not been too long or too deeply injured, will yield nearly their full amount of fat for animals or starch for the manufacturer.

Uses.—Besides being an indispensable vegetable, potatoes are boiled and mixed with flour for bread, to which they impart a desirable moisture and an agreeable flavor. They are sliced, dried and ground and much used in Europe as flour, and by the confectioners. They are also manufactured into tapioca and when nicely prepared, the product is not distinguishable from that of the manioc. In all of these and some other forms, they enter into consumption as human food. They are also used in large quantities by the manufacturers of starch; to some extent for distilling; and in a less degree for making sugar. The refuse of the pulp after extracting the starch, as well as the liquor drained from it, is used for cleansing woollens and silks, which it effects without injury to the color. But by far the greatest use of potatoes in this country is for stock feeding. They are eaten with avidity by all the brute creation either cooked or raw. For cattle and sheep, they are equally nutritious in either condition. For horses they are improved by steaming or baking. Swine and most poultry will subsist on them raw, but will fatten on them only when cooked. Their good effects are most enhanced by mixing with meal when they are hot, which partially cooks it.

THE SWEET POTATO (*Convolvulus batatus*)

Is a root of very general growth in the southern, and is much cultivated in the middle sections of the United States, and for the table is scarcely surpassed by any esculent. It is also greedily eaten and with great advantage by every species of stock.

Soil.—A dry and sandy or light loamy soil is best for them, and this should be well manured with compost scattered broadcast before working the ground, and thoroughly pulverized by repeated plowing and harrowing. It should then be thrown into beds 4 feet wide, (which may be easily done with the plow,) and in the centre of this strike a light furrow to receive the seed if the soil is dry, or plant it on the surface if moist.

Cultivation.—When the season is sufficiently long to mature them, the potato may be most conveniently planted by cutting the seed into slips and laying them 6 or 8 inches apart in the place where they are to mature. Large potatoes divided into pieces of a proper size are better for seed than small ones uncut. These should be covered about 2 inches with light mold. When they begin to sprout, the plow may be run close to the rows on either side to remove the earth and allow the full benefit of the sun and air to the roots, and as the plant advances in its growth, the earth may be gradually restored to them by the plow and hoe. Where the vines are so large as to be injured by the plow, the hoe alone should be used. The hill or drills may then be made broadly around the plants, hollowing towards them, to afford a full bed of rich, mellow earth, and to retain the rain which falls. They are fit for gathering when the vines are dead. Where the season is short or early potatoes are wanted, plant on a hot bed made of warm manure with a covering of 4 inches of fine mold. After splitting the potatoes, place them on this and cover with 3 inches of light earth. As the sprouts appear, draw and transplant them after a rain in the same manner as before suggested. When early vegetated, a bushel of seed will supply plants for an acre.

The *preservation* of the sweet potatoe through the winter is difficult. We have often heard planters complain that they could not preserve them, though their laborers are generally successful. The latter frequently store them under the floors of their cabins, by excavating a hole in the dry earth not far distant from their fires and cover with light mold. Great

care to seclude them from air and light, and absolute dryness seem to be essential to their preservation. They are frequently kept by piling in heaps on dry earth, which are still more secure with a layer beneath of corn stalks or dry pine boughs 6 or 8 inches deep. On this pack the roots in piles 6 feet in diameter. Cover with corn stalks and dry earth, and protect this with a roof of boards and a ditch deep enough to carry off all water. There must be a hole at the top slightly stopped with straw to permit the escape of heated air and to preserve uniformity of temperature. There are numerous *varieties* of the sweet potato, red, yellow, &c. They yield from 200 to 300 bushels per acre and under favorable circumstances sometimes double this quantity.

THE TURNEP (*Brassica rapa.*)

The common flat English turnep was introduced into this country with our English ancestry and has ever since been an object of cultivation. When boiled it is an agreeable vegetable for the table. Its principal value however is food for cattle and sheep by which it is eaten uncooked. Its comparative nutritive properties are small, but the great bulk which can be raised on a given piece of ground, and the facility and economy of cultivation, have always rendered it a favorite with such farmers, as have soil and stock adapted to its profitable production and use.

A GOOD SOIL for it is a fertile sand or well drained loam. Any soil adapted to Indian corn will produce good turneps. But it is only on new land or freshly turned sod, that they are most successful. An untilled virgin earth with the rich dressing of ashes left after the recent burning of accumulated vegetable matter, and free from weeds and insects, is the surest and most productive for a turnep crop. Such land needs no manure. For a sward ground, or clover ley, there should be a heavy dressing of fresh, unfermented manure before plowing.

CULTIVATION.—Turneps are sown from the 15th of June to the 1st of August. The first give a greater yield; the last generally a sounder root and capable of longer preservation. The ground should be plowed and harrowed immediately before sowing as the moisture insures rapid germination of the seed, which is of great importance to get it beyond the reach of insects as soon as possible. This may be sown broadcast at the rate of one or two pounds per acre and lightly harrowed and rolled; or it is better to be sown in drills, when a less

quantity of seed will suffice. A turnep drill will speedily accomplish the furrowing, sowing, covering and rolling at a single operation. The crop will be materially assisted by a top dressing of lime, ashes and plaster, at the rate of 15 or 20 bushels of the first, half the quantity of the second, and 3 or 4 bushels of the last, per acre. When the plants show themselves and the leaves are partially expanded, the cultivator or hoe may be freely used, stirring the ground well and exterminating all weeds.

Ruta-baga or Swedes Turnep.—The introduction of this is comparatively recent, and it proves to be more worthy of attention than the English or white turnep. It will bear a heavier soil, yield as well, give a richer root, and it has the great advantage of keeping longer in good condition, thus prolonging the winter food of cattle when they most need it.

Cultivation.—It is usually planted after wheat or corn, but if a fresh virgin soil or old pasture sod is chosen, it will materially lessen its liability to insects and other enemies.—It is generally sown in drills about 2 feet apart, and on heavy lands these should be slightly ridged. The plants must be successively thinned to prevent interfering with such as are intended to mature, but enough should remain to provide for casualties. Where there is a deficiency they may be supplied by transplanting during showery weather. They should be left 6 or 8 inches apart in the drills. The Swede turnep is a gross feeder and requires either a rich soil or heavy manuring, though the use of fresh manures has been supposed to facilitate the multiplication of enemies. Bones ground and drilled in with the seed, or a dressing of lime, ashes, gypsum and salt are the best applications that can be made. The Swede should be sown from about the 20th May to the 15th June, earlier than the English turnep, as it takes longer to mature, and 2 or 3 weeks more of growth frequently adds largely to the product. An early sowing also gives time to raise another crop in case of failure of the first.

Enemies.—The turnep is exposed to numerous depredators, of which the turnep flea-beetle is the most inveterate. It attacks the plant as soon as the first leaves expand and often destroys 2 or 3 successive sowings. The black catterpillar, slugs, wire-worms, and numerous other insects, grubs and aphides prey upon and greatly diminish the crop.

Remedies have been tried to an almost indefinite extent, but none hitherto with more than very partial success. Liberal sowing and rapid growth best insures the plant from in-

jury, and to effect this the seed should be plentifully sown, and if possible, when the ground is moist, and always in a rich soil. The seed should be steeped in some preparation which experience has shown will the most quickly develope the germ. Solutions of the nitrates or sulphates, urine, soot-water, liquid guano, currier's oil, &c. impregnate the first leaves with substances distasteful to their early enemies, and thus a short respite from their attacks will be secured. Gypsum, ashes, bone dust and poudrette, drilled in with the seed are excellent forcers for the young roots. Charcoal dust applied in the same way has been found to increase the early growth from four to ten-fold. When the fly, and bug, &c. is discovered, the application of lime, ashes or soot, or all combined should be made upon the leaves while the dew or a slight moisture is on them. This leads the young plant along, and kills such enemies as it reaches. Urine, diluted sulphuric acid, (oil of vitrol,) and other liquid manures will have the same effect. Ducks, chickens, and young turkies and birds will devour innumerable quantities, and their presence should always be encouraged not only on this, but on most of the fields. Dragging the surface with fine light brush will lessen the slugs and insects. The ground should be plowed just before winter sets in, which exposes the worms and the larvæ of insects to the frost, when they are unable to work themselves into a place of safety. The seed should not be planted on ground before occupied or near any of the order of plants *cruciferæ*, cabbage, radish, mustard, charlock and water-cress, as they all afford food for the enemies of turnips and thereby tend to their multiplication.

Harvesting may be deferred till the approach of cold weather, and in those sections of the country not affected by severe frosts, when on dry soils, they may be allowed to winter on the field. Otherwise they should be secured during the good autumnal weather. This is accomplished most expeditiously with a root hook, which is made with two-iron prongs attached to a hoe handle. The use of a bill hook or sharp knife will enable the operator to lop off the leaves with a single blow, when they are thrown into convenient piles and afterwards collected for storage.

The Storing may be in cellars or in heaps, similar to potatoes, but in a cooler temperature as slight heat injures them, while frost does not. If stored in heaps, one or more holes should be left at the top, which may be partially stop-

ped by a wisp of hay or straw to allow the escape of the gases which are generated.

THE FEEDING of ruta-bagas to cattle and sheep is always in their uncooked state. They are better steamed or boiled for swine, but their food should be sought from the more fattening products of the farm. In moderate quantity they may be given to horses, but they cannot be relied upon for them, as they are too bulky for working animals. Their place is much better supplied for horses by the carrot or potato. Their true value is as food for store and fattening cattle, milch cows and sheep, as they furnish a salutary change from dry hay, being nearly equivalent as a fodder to green summer food. They should be washed before feeding if too much dirt adheres to them, but if grown on a light soil, the tap roots lopped off and otherwise properly secured, they will not require it. They may be sliced with a heavy knife, or more summarily cut up while lying on the barn floor, with a sharp spade, or root slicer, which is made with a socket handle and two blades crossing each other in the centre at right angles, or by some of the numerous improved cutting machines. With an abundance of turneps and a small supply of straw, hay may be entirely dispensed with for cattle and sheep. Many of the best English breeds are kept exclusively on turneps with a little straw till ready for the shambles.

THE VARIETIES of turneps are numerous. After selecting such as will give the largest crop of the most nutritious roots, the next object in the choice of particular varieties should be to adapt them to the most economical use. Some will keep much longer than others, and if wanted to feed late in the season it may be necessary to take a variety intrinsically less valuable than another which must be earlier consumed. The English turnep should be first fed as it soonest wilts and becomes pithy, then follow with the others according to their order of maturity and decay. The leaves yield good forage, and if unmixed with earth may be fed dry or green to cattle.

The value of turneps to this country is trifling in comparison with that of many parts of Europe. In Great Britain alone, this value probably exceeds one hundred millions of dollars annually. But its culture here is much less desirable, as our drier climate and early and severe winters are not as well adapted to its production and economical preservation and feeding as those of England, and its numerous enemies render it an uncertain crop. These objections are increased by the important fact, that it enters into competition with our

Indian corn, which under ordinary circumstances, always gives a certain and highly remunerating return. It may sometimes however take the place of corn with advantage, and the turnip or some of the other roots should always occupy a conspicuous place in the change of winter food for cattle and sheep.

THE CARROT (*Daucus carota*)

Is one of our most valuable roots. It is a hardy, easy cultivated plant, and grows in almost every soil, and is next to the potato in its nutritive properties.

THE SOIL which best suits it is a fertile sand or light loam, but it will grow on such as are more tenacious if well drained, and deeply worked. The success of this and the parsnep depends much on the depth to which their roots can reach. Deep spading or subsoil plowing is therefore indispensable to secure large crops, and nearly all kinds of manure are equally suited for their food if well rotted. The ground should be thoroughly pulverized.

THE VARIETIES chiefly used for field culture are the long red, the orange, and white Belgian. The last under favorable circumstances, attains huge dimensions, and from its roots grow high out of the ground, it is supposed to draw more of its nourishment from the air, and to exhaust the ground less, while it is of course more easily harvested. But it is considerably below the others in comparative value.

PLANTING.—The carrot should be sown in drills, 16 to 20 inches apart, when the ground has become warm and dry. The seed is best prepared by mixing with fine mold or poudrette and stirring them well together to break off the fine beards; then sprinkle with water and allow it to remain in a warm place and occasionally turn it to produce equal development in the seed. It may remain 10 or 15 days be fore sowing till nearly ready to sprout. It then readily germinates and does not allow the weeds to get the start. The frequent use of the cultivator and entire cleanliness from weeds is all that is necessary to insure a crop, unless it be convenient to give it a top dressing of liquid manure, which the Flemings always do, and which no crop better repays. Two pounds of good seed will sow an acre. Any deficiency of plants may be supplied by transplanting in moist weather. Six inches is near enough for the smaller kind to stand, and 8 for the larger. They are subject to few diseases or enemies,

excepting such as can be avoided by judicious selection of soil and careful tillage.

THE HARVESTING may be facilitated by running a plow on one side of the rows, when the roots are easily removed by hand. The tops are then cut and the surface moisture from the roots dried, when they may be stored like turneps and potatoes. They ought to be kept at as low a temperature as possible above the freezing point. On the approach of warm weather they will sprout early if left in heaps, and if important to preserve them longer the crown should be cut off and the roots spread in a cool dry place.

USES.—Carrots are chiefly grown for domestic stock. Horses thrive remarkably on them, and some judicious farmers feed them as a substitute for oats. But their intrinsic value in weight, is less in the proportion of about 5 to 1. They are good for working cattle and unsurpassed for milch cows, producing a great flow of milk and a rich yellow cream. Sheep and swine greedily devour them and soon fatten if plentifully supplied with them. The Dutch grate them, and with sugar and salt, make a pickle for their choicest table butter. They are also employed in distilling. The average yield on good land may be estimated at about 300 bushels of the smaller, and 450 of the Belgian or white, per acre, but with extra cultivation, 1000 bushels of the last have been raised.

THE PARSNEP (*Pastinaca sativa*)

Is cultivated as a field crop and is of nearly equal nutritious value with the carrot. *The soil* may be heavier for parsneps than for carrots and they will even thrive on a strong clay if rich, well pulverized and dry. Large crops can only be obtained on deep, rich ground, well pulverized. They should be sown early as frosts do not affect them and they require a long time to come to maturity. Drilling at a distance of 20 inches apart, is the proper mode of planting, and they should be thinned to a space of 6 or 8 inches. It requires 4 or 5 lbs. of seed per acre which must be of the previous year's growth, as older does not readily vegetate. No preparation of the seed is necessary. The subsequent cultivation is similar to that of carrots, and they will generally yield more under similar circumstances of soil and tillage. They are little subject to disease or enemies.

THE GATHERING should be deferred till the frost leaves the ground in spring unless wanted for winter's use, as they keep

best in the ground where they are uninjured by the intensest frost. But particular care should be observed in allowing no standing water on them or they will rot. When taken up in the fall, the roots should neither be trimmed or broken, nor should the tops be cut too near the root. They must be stored in a cool place and covered carefully with earth, as exposure to air or even moderate heat wilts them.

Uses.—The parsnep is one of our most delicious table vegetables. It is an excellent food for swine either raw or cooked, and for cattle, milch cows and sheep it is highly prized. Qualey says, "it is not as valuable for horses for though it produces fat and a fine appearance, it causes them to sweat profusely, and if eaten when the shoot starts in the spring it produces inflammation in the eyes and epiphora or weeping." The leaves of both carrots and parsneps are good for cattle green or dried. Gerarde who wrote in 1596 says, "an excellent bread was made from them in his time." They have also like the carrot been used for distillation, and are said to afford a very good vinous beverage. The *best variety* for field culture is the large Jersey.

THE BEET (*Beta.*)

There are but two varieties of the beet in general use for the field, the sugar beet and mangold wurzel, both of which have several sub-varieties. They are of various colors, red, pink, yellow, white or mottled, but color does not seem to affect their quality. The conditions under which they grow are similar. Beets do well in any soil of sufficient depth and fertility, but they are perhaps most partial to a strong loam. If well tilled they will produce large crops on a tenacious clay. We have raised at the rate of 800 bushels to the acre on a stiff clay which had been well supplied with unfermented manure. The soil cannot be made too rich. For such as are adhesive, fresh or unfermented manures are much the best.

The planting should be in drills 20 to 24 inches asunder, at the rate of 4 to 6 lbs. of seed per acre, buried not over one inch deep. The seed should be early planted or as soon as vegetation will proceed rapidly, but must first be soaked by pouring soft scalding water on it, allowing it to cool to blood heat, and remain for 3 or 4 days, then roll in plaster and drill it in. The husk or outer covering of the seed is thick and impervious to moisture, and without a thorough previous saturation, will not readily germinate.

The CULTURE is similar to that of carrots and parsneps. They should be thinned to a distance of about 8 inches and all vacancies filled up with strong thrifty plants. It is better to sow thick enough to avoid the necessity of transplanting, for in addition to the time and expense of this operation, the new plants will not thrive as well as those which grow in their ranks from the seed. The above distances are suitable for the sugar beet; the mangold wurzel attains a larger size and the spaces may be increased. The practice of plucking off the leaves for cattle-feeding is objectionable, as it materially interferes with the growth of the plants. Scarcely any disease or enemy troubles it except when young. It is then sometimes though rarely attacked by grubs or small insects.

HARVESTING may be commenced soon after the first leaves turn yellow and before the frosts have injured them. The tops must not be too closely trimmed, nor the crown of the roots or its fibrous prongs cut from such as are destined for late keeping. If intended for early winter use, they may be abridged a trifle, and after the surface is dry, stored like other roots. They do not need as effectual protection as potatoes, for if the frost touches them under a covering of earth, it will gradually be withdrawn on the approach of warm weather and leave the roots uninjured; but they will not keep as long as if untouched by the frost. A slight opening for the escape of the gas, as with the other roots, should be left at the top and partially guarded with straw.

USES.—The beet is a universal favorite for the table and of great value for stock. Domestic animals never tire of it and swine prefer it to any other root excepting the parsnep. We have kept a large herd in the best condition through the winter on no other food than the raw sugar beet. They possess additional merit from their capability of resisting decay longer than the turnep, and frequently beyond the carrot and parsnep. They will be solid, fresh and juicy late in the spring if properly stored, and at a time too when they are most wanted for ailing sheep or cattle, milch cows or ewes, or for contributing to the support and health of any of the ordinary stock. When fed to fattening animals, they should follow and never precede the turnep. It has been found that such animals continue steadily to advance in flesh after being carried to a certain point with turneps if shifted on to the beet, but in repeated instances they have fallen back if changed from beets to turneps. Davy found in 1000 parts, the following quantity of nutritive or soluble matter. White

or English turneps, 42; Swede, 64; mangold wurzel, 136; sugar beet, 146. This order of nutrititive quality is followed by Boussingault, though he places the field beet and Swede turnep at nearly the same point. Einhof and Thaer on the contrary place the Swede before mangold wurzel. But in feeding to animals, unless for an occasional change, the roots should be given out in the order named. The sugar beet is seen to be more nutritious than the mangold wurzel, it is equally hardy and productive and more palatable to stock, and of course is to be preferred for raising. The former has been largely cultivated in France and Germany, for making into sugar, where it has been entirely successful, because protected by an adequate impost on the imported article. Their conversion into sugar has repeatedly been attempted in this country, but it cannot probably sustain a successful competition with the cane. From the experiments of M. Darracq, it has been found, that in summer the best yielded from 3½ to 4 per cent. of sugar, but in October after the commencement of frost, it gave only syrup and saltpetre, and no crystalizable sugar. When used for this purpose, the residuum of the pulp after expressing the juice is given to cattle. When wilted, the leaves are also fed to them, but caution is necessary to prevent their scouring. What are not thus used are plowed in for manure. The beet is also distilled and yields about half the product of potatoes.

THE JERUSALEM ARTICHOKE (*Helianthus tuberosus*,)

A native of Brazil, is a hardy plant, but little cultivated. Loudon says the name Jerusalem is a corruption of the Italian word *girasole*, (or sun-flower,) the blossom of which it closely resembles except in size. It flourishes in a moist, loose soil or sandy loam, with little care except to thin out and prevent weeds. It is very productive and easily cultivated in drills, three or four feet apart. The planting may be done in March or April. As it is not injured by frost and is very prolific, it will spread rapidly and often becomes a pest in the garden. The product is enormous, sometimes overrunning, it is said, 2,000 bushels per acre. Its nutritive qualities are much less than those of the potato, but its great productiveness and the facility of raising it, would seem to commend it to more general favor. Boussingault considers it an improving and profitable crop from

its drawing its nitrogen largely from the atmosphere. It is peculiarly fitted for a spring feed, as the roots lie uninjured by the vicissitudes of the weather, and may be taken out in perfection after most other roots are gone.

The USES of the Jerusalem artichoke in this country are both for human and animal food. The roots are generally used as a pickle or salad. Loudon says "they may also be eaten boiled, mashed in butter, or baked in pies, and have an excellent flavor." The tops when cut and cured as hay, afford a good fodder for cattle, and the roots are excellent for sheep and other stock. Swine will thrive upon them through the winter, and do their own harvesting when the ground is not locked up by frost.

NOTE.

We give on the following pages the table of nutrive equivalents of food, compiled by Boussingault, as a convenient reference, though not entirely reliable in all cases. For it will be seen from what has before been said, that the particular plants vary not only according to the season and soil, but also frequently, according to the particular variety subject to analysis. He says: "In the following table, to the numbers assigned by the theory, I have added those of the whole which I find in the entire series of observations that have come to my knowledge. I have also given the standard quantity of water, and the quantity of azote, contained in each species of food. When the theoretical equivalents do not differ too widely from those supplied by direct observation, I believe that they ought to be preferred. The details of my experiments, and the precautions needful in entering on and carrying them through, must have satisfied every one of the difficulties attending their conduct; yet all allow how little these have been attentively contemplated, and what slender measures of precaution against error have been taken. In my opinion, direct observation or experiment is indispensable, but mainly, solely as a means of checking within rather wide limits the results of chemical analysis."

TABLE OF THE NUTRITIVE EQUIVALENTS OF DIFFERENT KINDS OF FORAGE.

TITLE.	Standard water, ₱ ct.	Azote, ₱ ct.	Azote ₱ ct in the article not dried.	Theory.	Block.	Petri.	Meyer.	Thaer.	Pabst.	Flottow.	Pohl.	Rieder.	Generhausen.	Crud.	Weber.	Dombasle.	Krantz.	Schwertz.	Schnee.	Midleton.	Murre.	Andre.	Boussingault.
Ordinary natural meadow hay.	11–0	1–34	1–15	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Ditto, of fine quality	14–0	1–50	1–30	98	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ditto, select.	18–8	2–40	2–00	58	108	100	...	...	...	100	...	...	...	...	...	...	...	...	...	...	...	...	...
Ditto, freed from woody stems	14–0	2–44	2–10	55	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Lucern hay.	16–6	1–66	1–38	83	...	90	...	90	100	...	...	90	90	90	90	90	90	100	90	...	...	90	...
Red clover-hay, 2d y'r's growth	10–1	1–70	1–54	75	100	90	...	90	100	...	...	...	...	90	...	...	...	100	...	...	...	...	...
Red clover, cut in fl'r, green do	76–0	...	0–64	311	430	...	...	450	425	500	450	...	...	...	...	...	...	...	...	...	...	...	...
New wheat-straw, crop 1841. .	26–0	0–36	0–27	426	200	360	150	450	300	175	...	500	500	...	...	...	...	...	500	...	...	...	...
Old wheat-straw.	8–5	0–53	0–49	235	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Do, do, lower parts of stalk. . . .	5–3	0–43	0–41	280	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Do, do, upper part of do and ear	9–4	1–42	1–33	86	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
New rye-straw	18–7	0–30	0–24	479	200	500	150	666	35	175	...	...	660	...	...	...	...	...	666	...	...	...	...
Old ditto.	12–6	0–50	0–42	250	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Oat-straw	21–0	0–36	0–30	383	200	200	150	190	200	175	...	...	190	...	150	...	...	400	182	...	...	...	...
Barley ditto.	11–0	0–30	0–25	460	193	180	150	150	200	175	...	...	150	...	...	...	...	400	154	...	...	...	...
Pea ditto.	8–5	1–95	1–79	64	165	200	150	130	150	200	90	...	...	...	...	...	...	...	143	...	...	...	...
Millet ditto.	19–0	0–96	0–78	147	...	250	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Buckwheat ditto.	11–6	0–54	0–48	240	...	200	...	...	...	...	...	...	...	...	...	...	...	...	191	...	...	...	...
Lentil ditto.	9–2	1–18	1–01	114	160	200	...	130	150	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Vetches cut in flower and dried	11–0	1–16	1–14	101	...	125	...	...	100	...	...	...	90	90	...	...	...	...	90	...	...	...	...
Potatoe tops.	76–0	2–30	0–55	209	...	300	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Field-beet leaves.	88–9	4–50	0–50	230	600	...	...	...	600	...	...	...	...	600	...	...	...	...	...	...	...	...	...
Carrot ditto.	70–9	2–94	0–85	135	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Jerusalem potatoe stems	86–4	2–70	0–37	311	...	...	...	...	325	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Canada-poplar shoots.	62–5	2–29	0–86	134	67	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Oak ditto.	57–4	2–16	0–92	125	83	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Drum cabbage.	92–3	3–70	0–28	411	556	500	250	429	600	600	...	600	600	500	600	...	...	...	...	...	...	...	...
Swedish turnep.	91–0	1–83	0–17	676	...	300	...	300	250	...	350	370	350	...	...	...	...	200	...	...	...	350	...
Turnep.	92–5	1–70	0–13	885	533	600	290	526	450	500	525	555	525	525	500	...	...	450	...	800	667	...	...
Field-beet (1838)	87–8	1–70	0–21	548	366	400	250	460	250	300	...	...	460	255	...	261	...	333	...	...	...	...	400
Ditto, white Silesian.	85–6	1–43	0–18	669	366	...	...	...	...	...	...	...	...	...	...	220	...	...	...	...	...	...	...

Carrots	87-6	2-40	0-30	382	205	250	225	300	250		266	270	266	260	266	307	266	270		338			380
Jerusalem potatoes (1839)	79-2	1-60	0-33	348																			280
Ditto (1836)	75-5	2-20	0-42	274																			
Potatoes (1838)	65-9	1-50	0-36	319	216	200	150	200	200	250	200			210		187	227	200					280
Ditto (1836)	79-4	1-80	0-37	311																			
Do after keeping in the pit	76-8	1-18	0-30	383	400																		
Cider apple pulp dr'd in the air	6-1	0-63	0-59	195																			
Beet-root magma from sug. mill	70-0	...	0-38	303																			
Vetches in seed	14-6	5-13	4-37	26	30	54		66	40														
Field beans	7-9	5-50	5-11	23	30	54	50	73	40		50												
White peas (dry)	8-6	4-20	3-84	27	30	54	48	66	40		47												
Kidney beans	5-0	4-30	4-58	25		39																	
Lentils	9-0	4-40	4-00	29																			
New maize	18-0	2-00	1-64	70		52																	59
Buckwheat	12-5	2-40	2-10	55		64																	
Barley (1836)	13-2	2-02	1-76	65	33	61	53	76	50			52				47							
Barley-meal	13-0	2-46	2-14	54																			
Ditto	13-0	2-20	1-90	61																			
Oats (1838)	20-8	2-20	1-74	68		71		86	60		50	55										40	50
Ditto (1836)	12-4	2-22	1-92	60																			
Ditto (Parisian)	14-0	1-93	1-70	68																			
Rye (1836)	11-5	1-70	1-50	77	33	55	51	71	50	44	38	52					65		52				
Ditto (1838)	11-5	2-27	2-00	58																			
Wheat (1836, Alsace)	10-5	2-33	2-09	55	27	52	46	64	40								44						
Ditto (1838)	14-5	2-30	2-00	57																			
Ditto from highly manured soil	16-6	3-18	2-65	43																			
Recent bran	37-1	2-18	1-36	85	105																		
Wheat husks or chaff	7-6	0-94	0-85	135	160						175												
Rice (Piedmont)	13-4	1-39	1-20	96																			
Linseed cake	13-4	6-00	5-20	22	42	108									57								
Hemp ditto	5-0	4-78	4-21	27																			
Beech mast ditto	6-2	3-53	3-31	35																			
Dry acorns	...	...	0-80	143																			
Refuse of the wine press, air d'd	48-2	3-31	1-71	68		62			75														

CHAPTER X.

FRUITS.

The growing of fruits to the extent at least of the demands for his own use, should never be neglected by the farmer. The soil and climate of the United States are almost everywhere suited to their cheap and easy production. They are a source of profit for market purposes as well as useful to stock; and they afford some of the choicest and most economical luxuries for domestic use. Success in their cultivation may at all times be secured by a judicious selection of the fruit, the soil and location, and by proper attention thereafter.

THE APPLE.

The locality of the apple orchard should depend much on the climate and soil. In warm latitudes, a northerly exposure is perhaps best when not subject to violent winds, as these from any quarter are liable to blast the fruit while in blossom, and blow it from the tree before it is ripe. It is generally advantageous to protect an orchard from the bleak winds which prevail in its immediate neighborhood by a judicious selection of the ground. A warm and sunny position subjects the buds in spring to premature swelling, and these are often cut off by the severe spring frosts that follow, when an ordinary or northern exposure would retard their budding until the season was sufficiently advanced for their protection. The orchard should have a medium position as to exposure and the influences of the season.

Soil.—All the varieties intermediate between a stiff, unyielding clay and a light shifting sand, are friendly to the apple. The soil best suited to the perfection of fruit is a moist, friable, calcareous loam, slightly intermixed with fine gravel. This may run either into a sandy loam, which usually rests upon a sub soil of sand or gravel; or into a

clayey loam with a sub soil of stiff clay. Either of these is a good soil for the orchard. The ground should be rich enough for the production of good crops of grain, roots or grass. This state of fertility is absolutely necessary for the thrifty growth of the tree and its existence in a healthy and vigorous state. Springy or wet land is decidedly bad for an orchard, and if the farmer can appropriate no other for this purpose, it should be well drained, either by under-ground ditches or open trenches sufficiently deep to carry off the water for a depth at least two feet below the surface, so as to leave the soil perforated by the roots, in a warm and active state. Rocky and stony soils of the above descriptions are usually well adapted to the growth of fruit trees. The stones keep the ground moist, loose and light. Some of the finest fruits grow where there is scarcely room to deposit the tree between the huge rocks. They should not however lie too deep when close together, as they will impede and control the growth of the roots. A sufficient area of earth is always necessary for an ample growth of wood and the full size of the tree at maturity. Stiff clays and light blowing sands under very nice cultivation will grow fruits, but they require active manure. Clays should be often plowed, particularly in the fall, that the soil may be ameliorated by the winter frosts. The sands require compact culture, and appropriate manures. All such as are suited to ordinary crops on these lands will promote the growth of trees. The use of other soils however for the orchard should be preferred, as the fruit will be larger, fairer and better flavored, and the trees of much longer duration.

Planting.—Dig the holes from three to six feet in diameter and twelve to eighteen inches deep, according to the kind of soil and the size of the tree. The more compact the soil, the deeper and larger should be the hole. When ready to plant, let enough of the best or top soil be thrown into the botom of the hole, so that the tree may stand about one inch lower than when removed from the nursery. The tree should be taken up so as to injure the roots as little as possible. If any be broken, cut them off, either square or obliquely with a fine saw or sharp knife. If left in their bruised or broken condition, they will canker and decay in the ground, but if thus cut off, numerous rootlets will spring out at the termination of the amputated root, which strikes into the soft earth and give increased support to the tree. If the soil be poor, the roots should be covered and the holes

filled with good earth. If the hole be small, the surrounding land hard, and the roots bent up and cramped, the tree cannot grow, or if after a long time of doubt and delay, it finally survives, it creeps along with a snail's pace, making little return to the planter. If the tree be crooked, confine it with a straw band to a stake firmly planted in the ground. This is the best ligature, as it does not cut the bark, which small cords often do, and it gradually gives way as the tree increases in size. When thus planted, well manured and looked after subsequently, the tree thrives and in a few years rewards the owner with its delicious and abundant fruit.

The season of planting may be any time after the fall of the leaf by frost in autumn, till its reappearance in the spring, provided the ground be not frozen. Early spring is to be preferred for planting *stone* fruits. They may be planted while in embryo leaf and blossom with entire success, but it is usually best to do this before the bud is much swollen.—If one time be equally convenient with another, we recommend fall planting for fruit generally, as the earth then becomes settled about the root early in the season. This is particularly advantageous when the spring is succeeded by a severe summer's drought. So important is the operation of planting, that it is better to have one tree well planted, than three planted badly, and more fruit may be anticipated within the first ten years if not forever, from the first one than from all the others. It some times occurs that in removing trees from a great distance, they arrive too late in the fall to be properly transplanted. In such case a trench should be dug in soft earth and the trees laid at an angle of about 45°, three or four inches apart, the roots carefully placed to prevent breaking, and the earth piled on them for a foot up the trunk, and eight or ten inches over the roots. This will preserve them until spring without detriment to their future growth.—The practice is adopted by nurserymen and others, who often transplant their trees from one location to another without loss or difficulty. Trees should never be planted in the apple orchard at a less distance than two rods, and forty feet apart is better. Close planting prevents the trees from receiving the requisite quantity of sun and the free circulation of air, both of which are essential to the size, flavor and perfection of fruit. Forty trees will plant an acre, at the distance of two rods apart. The consequence of closer planting is the premature decay of the trees and an inferior quality of fruit.

Cultivation.—A previously uncultivated or virgin soil is the best for an orchard, but if such is not to be had, that which has been long in pasture or meadow is most suitable. The most efficient manures are swamp muck, decayed leaves and vegetables, rotten wood, chip manure, lime, ashes, gypsum, &c. Trees, like any other vegetable, draw their own specific food, largely from the soil, and to supply the elements of their growth in abundance, the earth should occasionally be renewed with those materials which may have become partially or wholly exhausted. When carefully plowed and cultivated in hoed crops, orchards thrive most rapidly, care being always taken to protect the trees from damage either to the trunks or roots. All tearing of the roots is objectionable. The ground should be kept rich and open, so as to be pervious to the influence of rains, the sun and the atmosphere. Under these conditions the trees will thrive vigorously. When lands are kept in grass, a space of three to six feet in diameter, according to the age and size of the tree, should always be kept free from turf around them. Pastures which are trodden by animals, are so bared by this and the closeness of their cropping that the roots of the trees get their share of benefit from the sun and rains. From this cause pastures are better suited to orchards than mowing lands; for the latter are so completely covered by the rank growth of grass that the tree suffers, and without the aid of manures and the annual loosening of the ground for a few feet around, the tree in some cases dies from exhaustion. All kinds of cereal grains are bad for orchards, except perhaps buckwheat. The preparation of the ground for this crop by early summer plowing, is highly condusive to the growth of trees, and its nutriment being drawn largely from the air, it robs the roots of a small amount only of the materials in the soil.

A neighboring farmer, whose management many years since came under our notice, had a small mowing lot adjoining his barn and cattle sheds, which was surrounded with a stone wall. The soil was a moist gravelly loam, every way fitted for the growth of apple trees, as was shown by there having been several flourishing orchards on similar soils in the immediate vicinity. He filled this with apple trees set in small holes at the proper distances, the rows terminating on each side close to the wall and also near his barn and sheds. After setting out, the trees were staked and then left to grow, as best they could without farther cultivation.

Those remote from the wall and buildings remained stationary for several years, while those under their influence, after two or three years began to show a vigorous growth. The grass was removed annually and the trees received no cultivation, save perhaps a bushel or two of chip manure occasionally thrown around them. Twenty years after they were planted, the trees next to the wall and buildings were thrifty and had attained a large size, while many of the others had died, a few had grown to one-fourth the size of the outer ones and others were still smaller, mossy and showing signs of a premature old age. Not one-third of the trees gave any return whatever. The wall and buildings kept the soil next them light and moist, while that in the more open field spent all its energy upon the grass. An orchard to be productive and profitable, *must be cultivated*, and without this, it is useless to plant it.

Pruning.—This operation should commence at the planting of the tree, the top of which should always be in proportion to the size and number of the roots. If the top be high and spindling, shorten it so as to throw the lateral shoots into a graceful and branching form. The limbs may commence about six feet from the ground. The pruning should be done annually as the labor is then trifling, and the expenditure of vital force in maturing wood which is afterwards to be cut off is thus saved, and the branches to be removed being small the wounds readily heal. In this case no covering is required for the wound as one season's growth will heal it. The top should be sufficiently open to admit the sun and air.—The best time for trimming is when the tree is in bloom, and the sap in full flow. The proper instrument is a fine saw or sharp knife, and the limb should be cut off close to the remaining branch. The sap at this time is active, and is readily converted into new bark and wood, which speedly forms over the cut. But this is a busy season with the farmer, and if he cannot then prune his trees he may do it when more convenient, taking care to secure the wounds by an efficient covering of salve. *Old trees* or such as are growing vigorously and have been long neglected, often require severe trimming, which should always be done in May or June, and when the wounds are large they should be covered with a coat of thick Spanish brown paint or grafting wax. If they are left exposed and the growth of the tree be slow, decay will often take place before they are healed. Too much care cannot be used in these operations. In large trees, a ladder

should always be at hand to avoid breaking the limbs by the weight of the operator. If by too close planting the branches of different trees be brought into contact, thorough pruning is absolutely necessary, as without it good fruit cannot be obtained.

GRAFTING AND BUDDING.—These operations are so simple, and usually so well known by some individual in every farming neighborhood, that no written description of either operation is necessary. *Grafting wax* of the best kind is thus made. Take four parts of rosin, one of tallow and one of beeswax, melt and stir them well together, then pour them into a bucket or pan of cold water. As soon as cool enough to be handled, work it over and draw it out like shoe-maker's wax until it is entirely pliable. It may then be used immediately or laid up and kept for years. The mode of applying it is known to every grafter. *Scions* should always be of the growth of the preceeding year and cut from well ripened, thrifty wood in the months of January, February or March, before the buds begin to swell with the flow of the spring sap. Tie them up and keep in a moist cool place, a cellar bottom, or box of moss or earth till ready for use. When circumstances require it, grafts may be cut at any time after the fall of the leaf, but the months indicated are best in all localities north of the Potomac and Ohio rivers. July and August are the best time *for budding*. This should always be done while the sap is in flow and the bark is loose, as at no other time is success certain.

SELECTION OF TREES.—These should always be selected from seedlings. Suckers from the roots of grown trees are objectionable as tending to throw up suckers themselves which are always troublesome. When they appear, these should be cut close to the root or stem, and if properly done, they will rarely sprout anew.

PLANTING THE SEED.—If the farmer wish to raise his own trees, he can sow the seed or pomace in rows in the fall. After they come up in the spring, weed and hoe them like any vegetable. When a year old, they should be carefully taken up, the tap root cut off and replanted in rows four feet apart, and at least a foot distant in the rows, when they should be regularly trimmed and cultivated till they are 1½ or 2 inches diameter at the base, at which time they are fit for the orchard. These operations are however the appropriate business of the nurseryman, for whose guidance there should always be at hand, some standard work on the cultivation of fruits,

Of these, Kenrick's and Downing's are at present, the best American treatises.

Gathering and Preserving.—For immediate use apples may be shaken from the tree. For winter consumption or packing for market, they should be carefully picked by hand with the aid of ladders, to avoid bruising the fruit and injuring the limbs. To preserve apples, the best method is to lay them carefully into tight barrels or boxes, immediately after picking with a thin layer of perfectly dry chaff on the bottom; and after being lightly shaken together, another layer of chaff on the top may be added, though this is not essential. They may then be tightly headed or covered so as to exclude the air. The boxes or barrels should then be put away into a dry place, and kept as cold as possible above the freezing point. But if slightly frozen, they will not be injured if suffered to remain unpacked till the frost leaves them. Thus managed they will keep as long as they are capable of preservation. Bins in the cellar are good for ordinary use if closely covered. If exposed to the air, warmth or moisture, apples soon decay. If too dry, they wilt and become tasteless. They are sometimes buried in the earth like potatoes, but this is very liable to impair the flavor and give them an earthly taste; and they seldom keep so well after removal in the spring as when they have been stored in barrels.

For farm stock apples are extremely profitable, and the better the quality of fruit the more valuable are they for this object. A variety of both sweet and sub-acid should be cultivated. The sacharine matter of the apple is the principal nutritive property and this abounds in some kinds of the sub-acid. Animals like a change in their food as well as man, and both these varieties should, therefore, be fed to them alternately. When the soil and climate are adapted to them, we have no doubt that apples for stock, can be grown cheaper than any other kind of food, excepting grass. Hogs have been often fatted upon them with an occasional change to grain; and when fed to horses, neat cattle, and sheep with hay, they are almost equivalent to roots. That tree must be badly cultivated which in ten years after planting will not produce five bushels of apples; and these, at ten cents a bushel, give an annual revenue of fifty cents a tree, or twenty dollars per acre for stock-feeding alone. At twenty years old, the tree will double that product, casualties excepted, and as this estimate is based on their least valuable use, an increased profit, of course may be anticipated from their conversion to other

purposes. Good apples are rarely worth less than twenty-five cents a bushel in market; often three or four times that amount. The ranging of swine among any kind of fruit trees greatly conduces to their health and growth. Besides the support of the swine, their consumption of windfalls secures the destruction of the insects in them. Sheep, turkies, ducks and chickens answer the same purpose when suffered to frequent them in sufficient numbers.

MAKING CIDER.—Good fruit is indispensable to the making of good cider. The suitable time for this is in October and November, and apples to be thus appropriated should ripen in these months. Such as are slightly acid are excellent for this purpose. As far as practicable, the fruit should be of one kind, fully ripe, yet sound and undecayed. The mill must be thoroughly cleansed with hot water, and capable of grinding the pomace fine. This should lie in the vat at least forty-eight hours after grinding, and be turned once or twice before its removal into the cheese. Pomace so exposed absorbs large quantities of oxygen, thus undergoing a necessary change for its conversion into good cider. All fruits are subject to this change to a certain extent just before ripening. When their juices are expressed or the pulp broken and exposed to the air this effect is increased, and constitutes the *saccharine fermentation*. In both cases, the result is to increase the palatable and nutritive properties of the fruit, by converting the starch, gum and other vegetable matters into sugar.

When the pomace has been sufficiently pressed, it may be fed to cattle, sheep, or swine, and the liquor put into barrels in a cool place and allowed to remain till the pulp or feculent matter has been thrown out at the bung, and to aid its removal the barrel should be kept full. The second fermentation is the *vinous*, and by it a portion of alcohol is developed, which is slowly continued afterwards in the enclosed cask, until it reaches from 6 to 9 per cent. When fermentation apparently subsides, the cider should be drawn into clean barrels and tightly bunged. Previous to doing this, a little sulphur should be burned in the cask to arrest the fermentation. The addition of charcoal, raisins, mustard seed, fresh meat, &c. produces the same effect. After standing two or three months, closely confined in a cool place, it may be drawn off and tightly bottled for use. Its long preservation and improvement will depend on its being kept cool and well corked. In addition to its possessing a small proportion of alcohol, it

then contains large quantities of carbonic acid gas, which occasions its lively effervessence when uncorcked, and gives to it that peculiarly pungent and agreeable flavor so highly relished.

Vinegar.—If the cider be allowed to remain in the cask in which it is first placed, and exposed to a warm temperature, it continues greedily to absorb oxygen and quickly undergoes another fermentation called the *acetic*, by which it is converted into vinegar; and even if intended solely for this purpose, the best and richest fruit is most valuable. When the vinegar has acquired its perfection it should be kept air-tight at a low temperature.

Best varieties of apples for cultivation.—Almost every section of the apple-growing regions of America has a greater or less variety peculiar to itself, and their valuable properties appear more fully developed in these localities than when removed to others. Such should of course be retained when of extraordinary excellence. There are varieties, however, which are of more general cultivation, cosmopolites throughout the apple climates, of fine quality, and possessing all the excellence of which the genus is capable. Thirty different kinds for each section or state, will probably include all which it is desirable to cultivate, and for any one location perhaps twenty is sufficient. We here name 30 standard varieties, all of which are now in successful cultivation in different parts of the United States and the Canadas. The names and descriptions are those of Downing, as published in his late work on the Fruit Trees of America, 1845.

Summer Apples.—Early Harvest, Red Astracan, Large Yellow Bough, Williams' Favorite.

Autumn Apples.—Golden Sweet, Fall Pippin, Gravenstein, Jersey Sweeting, Pumpkin Russet, (by some, the Belle-bonne,) Rambo.

Winter Apples.—Westfield Seek-no-farther, Baldwin, Black Apple, Yellow Belle fleur, Detroit, Hubbardston Nonesuch, Green and Yellow Newtown Pippin, Northern Spy, Blue Pearmain, Peck's Pleasant, Rhode Island Greening, American Golden Russet, English Russet, Roxbury Russet, Swaar, Ladies' Sweeting, Talman's Sweeting, Esopus Spitzenberg, Waxen Apple, Wine Apple.

THE PEAR.

The pear is the most valuable and one of the most luscious and wholesome market fruits, though not comparable to the

apple for variety and general use. In a good soil and under proper cultivation, it is both vigorous and hardy. It is budded and grafted like the apple, and requires the same treatment; it is as easy of propagation, attains a greater size and age, and although longer arriving to maturity, it is a more abundant bearer. Its favorite soil is a clay loam. It needs little pruning as it usually throws out an upright, graceful head, free from excessive bushiness. The trees may be planted 25 or 30 feet apart, an abundance of sun being requisite to full bearing and the perfection of the fruit.

Diseases.—The pear is seldom subject to more than one formidable disease, the fire blight, and to this some localities are more subject than others. The disease manifests itself generally in mid-summer, in the sudden withering of the leaves on one or more branches. The only effectual remedy is to cut off and burn the diseased limb immediately on its discovery. The causes are imperfectly known, but it has been variously ascribed to the presence of minute insects, to the abundant flow of sap and to the severity of the winter.

Collecting and preserving the fruit.—The pears intended for market or for long keeping, should be hand-picked and laid in a cool place; and when perfectly dry put up in casks like apples. Winter pears should be packed for preservation like winter apples.

The varieties to be selected depends entirely on the object of their cultivation. For market the best and most popular kinds only should be chosen, and for family use, an equally good selection should be made of those running throughout the entire season.

We name in their order of ripening, a dozen choice kinds, the cultivation of which has thus far been thoroughly successful and the qualities universally approved. The most of these are pears of American origin, which are to be preferred as promising more durability, hardiness and perfect adaptation to our climate and soils. We quote Downing.

Summer and Early Autumn Pears.—Bloodgood, Dearborn's Seedling, Bartlett or Williams' Bon Chretien, Stevens' Genesee.

Autumn Pears.—Beurre Diel, Dix, White Doyenne or Virgalieu, Duchess D'Angouleme.

Winter Pears.—Beurre D'Aramberg, Columbia, Winter Nelis, Prince's St. Germain.

THE QUINCE.

This is also a valuable market fruit. It makes a rich, highly flavored sweetmeat, and to this use it is entirely limited. The tree is easily raised by suckers and the cuttings, and should be planted fifteen feet apart, in a rich, warm, heavy soil, (a clayey loam is the best,) rather moist, and in a sunny exposure where it will be well sheltered from severe and cold winds. The wash of a barn yard is its best manure, and it repays equally with the apple, for good cultivation. The fruit is large, sometimes weighing a pound, of a rich yellow color, and generally free from worms and other imperfections. It ripens in October and November. The orange quince is the best variety for common cultivation. The tree requires but little pruning. The trunk may be entire for two or three feet, or branch from the ground by two or more stems. The top should be kept open to admit the sun and air, and the trunk freed from suckers. So treated it will live long and produce abundantly.

THE CHERRY.

Aside from the value of its fruit, the cherry is an ornamental shade tree, hardy and vigorous in its growth, and easy of propagation. It should be planted like the apple. For culinary purposes, the common red cherry is perhaps the best. This may stand sixteen to twenty feet apart, according to soil and situation. The large Mazard or the English cherry requires more room, and if on a deep, warm, sandy loam, its favorite soil, it should be planted two rods apart, as it grows to a large size. It will flourish luxuriantly on a clay loam, or on an open gravel, provided the soil be rich and deep; but on these, it demands more careful cultivation. It seldom requires much pruning. Care must be used with this as with all other fruit trees, to give it an open head and to keep the limbs from crossing and chafing each other. The varieties most in use are the ***Common Red Kentish or Pie Cherry***, with which every one is familiar, the ***English Mayduke***, ***Black Tartarian Bigarreau***, (Graffion or Yellow Spanish.) the ***large Red Bigarreau***, ***Elton***, ***Belle de Choisy*** and the ***late Duke***. These will form a succession of six weeks in ripening and embrace the entire cherry season. The cherry is remarkably free from disease and it usually requires but ordinary care in its cultivation.

THE PLUM.

In its superior varieties, this is a delicious fruit, and is generally easily cultivated. It prefers a strong clay loam, but does well in any ordinary ground except a light sand. It should be planted like the apple, though on a smaller scale, as it has a smaller and less vigorous growth. The proper distance is sixteen to twenty feet apart. There are two formidable impediments in the cultivation of the plum. One is an insect, which attacks the wood, and deposits its egg in the smaller branches. This is followed by a large swelling or excrescence and if suffered to remain, will soon destroy its productivness. The best and surest remedy is to cut off the branch at once and burn it. *The Curculio* commits its depredations on the young fruit soon after the blossoms disappear. These are frequently so destructive as to kill the fruit of an entire orchard. Several methods of destroying them have been suggested of which the most simple and effectual is, to plant the trees in such places as will admit the swine and poultry to feed upon the fallen fruit and insects. Salt sprinkled around the tree in the spring is said to destroy them. The smoke of rotten wood, leaves and rubbish which have been burned under the trees when in blossom has sometimes proved beneficial. Paving the earth under the limbs to prevent the burrowing of the insects, and some other remedies are recommended. This is a serious evil, requiring more observation and experiment than it has yet received.

Varieties.—The common blue or horse plum is cultivated in numerous sub-varieties. Some of these are very good, others utterly worthless. Good plums are as easily raised as poor ones. Young trees bearing an indifferent fruit, can be headed down and grafted as readily as apples, but this requires to be done a month earlier in the spring and before the buds begin to swell. The best kinds are the Yellow, Green, Autumn, Bleeckers, Imperial, Prince's Yellow, Frost, Purple, and the Red Gages; Coe's Golden Drop, the Jefferson, the Grange, the Washington, the Columbia, Smith's Orleans, and the Red Magnum Bonum.

This last variety is more liable to the attacks of the circulio than many others. But its vigorous growth, great productivness when not attacked and its excellent quality for the table renders it a desirable fruit. *For drying*, the German prune is perhaps the best, although several of the plums

above named answer an excellent purpose. We have enumerated a larger variety of plums from the difficulty in our northern climates generally, of cultivating the peach, which ripens nearly at the same time, and although not so delicious a fruit, the plum is a valuable substitute for it. It is a more durable tree though liable to several diseases, and its cultivation is comparatively easy.

THE PEACH.

This fruit on virgin soils and in the early settlement of our country, was one of the easiest of propagation and most abundant in its bearing, but it is now the most uncertain in its maturity and the shortest lived of all. So liable is it to casualties as to have become almost entirely discarded in large sections of the United States, where it once flourished in the highest perfection. It is now generally reared on an extensive scale for market by those who make it an exclusive business.

Its FAVORITE SOIL is a light, warm, sandy or gravelly loam, in a sunny exposure, protected from severe bleak winds. Thus situated and in favorable latitudes, it often flourishes in luxuriance and produces the most luscious fruit. In Western New-York and on most of the Southern borders of the great Lakes the peach grows more vigorously and lives longer than in any other sections of the United States, frequently lasting 20 or 30 years, and bearing constantly and in abundance.—Peaches are produced in immense quantities in the States of New Jersey and Delaware, on the light soils near the Atlantic coast for the large city markets, and in those states the crop of a single proprietor often amounts to $5000, and sometimes exceeds $20,000 annually. None but the choicest kinds are cultivated, and these are inoculated into the seedling when a year old. They are transplanted at two and three, and are worn out, cut down and burned at the age of from six to twelve years. The proper distance at which they should be planted is sixteen to twenty feet apart, according to situation, soil and exposure. Constant cultivation of the ground is necessary for their best growth and bearing.

DISEASES.—It is liable to many diseases and to the depredations of numerous enemies. *The Yellows* is its most fatal disease, and this can only be checked by the immediate removal of the diseased tree from the orchard. *Of the Insects*, the grub or peach worm is the most destructive. It punctures the bark, and lays its egg beneath it at the surface of the earth, and when discovered it should be killed with a pen-

knife or pointed wire. A good preventive is to form a cone of earth a foot high around the trunk about the first of June; or if made of leached ashes it would be better. Remove this heap in October, and the bark will harden below the reach of the fly the following year.

VARIETIES.—The best kinds in succession from early to late, are the Red and Yellow Rareripes, Malacatune, Early York, Early Tillotson, George the Fourth, Morris' Red and White Rareripes, Malta and Royal George. These succeed each otherfrom August to October.

THE APRICOT AND NECTARINE.—These are of the peach family, but generally inferior as a fruit and much more difficult of cultivation, being more liable to casualties and insects. They require the same kinds of soil and cultivation as the peach with a warm exposure. As they are propagated solely as an article of luxury and are not wanted for general use, we omit further notice of them.

THE GRAPE.

The details for the proper rearing of this fruit demand a volume, but we can only refer to some prominent points in its cultivation. It grows wild in abundance and of tolerable quality in many parts of the United States, climbing over trees, rocks and fences in great luxuriance. We have seen in the Eastern States a dozen excellent native varieties of white, black and purple, of different sizes, shapes and flavor, growing within the space of a single furlong. So abundant were the clustering vines on the Atlantic coast in the vicinity of Narraganset Bay, that the old Northmen who discovered, and for a short time occupied the country in the 12th century, gave it the appropriate name of *Vinland, or the Land of Vines.* The finer kinds require loose, shelly soils with warm, sunny exposures and proper trimming. Thus cultivated they are often raised with profit. The more choice and delicate kinds must have protection in winter and glass heat in summer, and are therefore better suited to large towns, or to a well arranged conservatory.

VARIETIES.—The best American kinds are the Isabella and Catawba, for the Middle, and the Scuppernong for the Southern States. North of latitude 41° 30' neither of the two former ripen certainly except in long, warm seasons, and it would be better for the cultivator north of this to select some of the hardiest and best wild grapes of his own latitude for out-door propagation. Grafting a foreign variety on a

hardy native stock has been found to give a choice fruit in great abundance, and with more certainty than could be secured by an entire exotic. Of the European, the varieties of Chasselas, Black Hamburgh, and White Muscat of Alexandria, are the best. In a good grapery and with artificial heat and proper attention, these can undoubtedly be raised at a price which would yield to the horticulturist an adequate return, and for this purpose they are the best kinds to propagate, furnishing a long succession of fruit in its finest variety.

THE CURRANT

Is the first in importance of the small garden fruits. In cookery it has many valuable uses and is wholesome and delicious when ripe. It grows with the greatest certainty and luxuriance either from the suckers or cuttings. The ground should be rich and well worked and the bushes set at least six feet apart. They require plenty of sun and air like all other fruits. The Red is the most common kind, but the large Dutch White is sweeter and more delicious, a great bearer, larger, and as easily cultivated. The English Black is very productive, of great size, and makes a fine jelly. It has peculiar efficacy in sickness. The usual mode of planting currants near fences is objectionable. They should stand out where the gardener can get around them and where the fruit can have plenty of air and sun. This improves the fruit, and insects and vermin are more effectually prevented from harboring beneath the bushes.

THE GOOSEBERRY.

This makes a palatable tart and as a ripe fruit possesses some excellence. It is easily raised, and prefers a cool, moist, rich soil in a sheltered position. It has been brought to the highest perfection in Lancashire, England, and in Scotland, under the influence of their cool weather and interminable fogs and rains. It has long been cultivated in America, but with little success; for though frequently abundant, the flavor is indifferent in comparison with American fruits generally. For those who design to cultivate them, the nursery catalogues are a sufficient reference. As a tart they are inferior to the *rhubarb, or pie-plant,* which can be grown with little trouble or expense, in great profusion in every fertile and well tilled garden; and it is in season from May till August, when apples are sufficiently advanced to take its place.

THE RASPBERRY.

Both Red and Black Raspberries are favorably known as a wild American fruit. As market fruit near the large cities, it is very profitable. It prefers a light, warm, dry soil, rich and thoroughly loosened. The best varieties grown are the Red and Yellow Antwerps, which produce abundantly and are of fine flavor; the Franconia, a fine, large, purple French fruit; and the Fastolf, a late English Red variety of superior size and flavor. The above kinds are all hardy in latitude 43° north. They are propagated by suckers, and should be planted three feet apart if in hills, and four feet if in rows.—The stalk lives but two years. The first season it shoots up from the root and makes its growth. The next Spring it should be topped to three feet in height, the old stock cut out, and the bearing ones (which ought never to exceed three or four in a clump) should be securely tied to a stake or trellis. If the ground be well hoed they will bear profusely.

THE STRAWBERRY.

This delicious and wholesome fruit is rapidly spreading in garden cultivation throughout the United States. It will flourish in almost any good soil which is not too cold or wet. The plants should be set in rows two feet asunder and one foot apart in the rows, kept clear from weeds and the runners cut off once or twice in the growing season. Beds will last from three to six years, depending, in a measure, on the mode of cultivation. The fruit is in season from three to six weeks, according to their kinds. Many cultivators have found difficulty in procuring an abundant supply of the strawberry, which is probably owing (when other circumstances are favorable,) to an improper arrangement of the male and female plants. Hovey's Seedling and several others demand the presence of the male plant from some other variety, to fertilize them. The most popular for the market are sub-varieties of the Scarlet, Pine, Chili and Wood. Among these the Methven Castle, Keene's and Hovey's Seedlings are most highly celebrated.

THE AMERICAN CRANBERRY (*Oxycocus macrocarpus*)

Yields one of the most delicious of our tart esculents. It is found in great abundance in many low, swampy grounds in our northern and western states; and although it has been gathered from its native haunts from the earliest settlement of the country, yet it is only within a few years that it has be-

come an object of cultivation. Experience has probably not yet fully developed the most certain means of attaining the greatest success, but enough is already known, to assume that they are a profitable object of attention to the farmer.

Soil and cultivation.—They are generally planted on low, moist meadows which are prepared by thorough plowing and harrowing. They are then set in drills by slips and roots, usually in the spring, but sometimes in autumn, about 20 inches apart and at distances of about 3 inches. They require to have the weeds kept out and the ground stirred with a light cultivator or hoe, and they will soon overrun and occupy the whole ground. An occasional top dressing of swamp muck is beneficial. Mr. Bates of Massachusetts has in this way, produced at the rate of 300 bushels per acre, which were worth in the market from one to two dollars per bushel. Capt Hall of the same state, raises them in a swamp, first giving it a top dressing of sand or gravel to kill the grass, when he digs holes 4 feet apart, and inserts in each a sod of cranberry plants about one foot square. From these sods they gradually spread till the whole surface is occupied.

The cranberry is sometimes killed by late or early frosts, and it has been suggested, that these might be avoided by having the fields so arranged when they may be expected as to be slightly covered with water. The cranberry is gathered when sufficiently ripe, by raking them from the bushes. They are cleaned from the stems, leaves and imperfect berries, by washing and rolling them over smooth boards set on an inclined plane, in the same manner as imperfect shot are assorted. After this they are put into tight casks and filled with water. If stored in a cool place, the water changed at proper intervals, and the imperfect berries occasionally thrown out, they will keep till the following summer. They will frequently bring $20 per barrel in European markets. The raking is beneficial rather than otherwise to the plants, for though some of the plants are pulled out and others broken, their places are more than supplied by the subsequent growth.

CHAPTER XI.

MISCELLANEOUS OBJECTS OF CULTIVATION.

BROOM CORN (*Sorghum saccharatum.*)

So far as we are acquainted with its history, this is a product peculiar to America. In its early growth and general appearance it resembles Indian corn. It stands perfectly upright at a height of ten feet or more, with a stalk of nearly uniform size throughout, from which an occasional leaf appears ; and at the top a long, compact bunch of slender, graceful stems is thrown out, familiarly termed the *brush*, which sustain the seed at and near their extremities.

Soil.—The best soil for raising broom corn, is similar to that required for Indian corn or maize. It should be rich, warm, loamy land, not liable to early or late frosts. Spring frosts injure broom corn more than maize, as the roots do not strike so deep, nor has it the power of recovering from the effects of frost equal to the latter. The best crops are usually raised on a green sward, turned over as late as possible in the fall, so as to kill the worms. Clay lands are not suitable for it.

Manure.—Hog or sheep manure is best, and rotten better than unfermented. If the land is in good condition, three cords, or eight loads to the acre is sufficient. This is usually placed in hills and 12 to 15 bushels of ashes per acre may be added with great advantage. Plaster is beneficial at the rate of two to four bushels per acre. The addition of slacked lime helps the ground, affords food to the crop, and is destructive to worms. Poudrette at the rate of a gill or so to each hill at planting, or guano at the rate of a table-spoonful per hill, if the African, or two-thirds the quantity if Peruvian, mixed into a compost with ten times its quantity of good soil, is an excellent application, especially if the land is not in

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very good heart. To repeat either of the above around the stalks on each hill after the last hoeing, will add materially to the crop.

PLANTING.—It should be planted in hills two feet apart, in rows two and a half to three feet distant. If the seed is good, 15 to 20 seeds to a hill are enough; if not, put in sufficient to ensure eight or ten thrifty plants, which are all that require to be left for each hill. Time of planting must depend on climate and season. The 1st of May is time for planting in latitude 40°, and 10th to 15th in 42°, but as early as possible, yet late enough to escape spring frost is best. The ground should be thoroughly harrowed and pulverized before planting. Thick planting gives the finest, toughest brush. Seed should be buried one to one and a half inches deep.

AFTER CULTURE.—As soon as the plants are visible, run a cultivator between the rows, and follow with a hand hoe. Many neglect this till the weeds get a start, which is highly prejudicial to the crop. The cultivator or a light plow should be used afterwards, followed with a hoe, and may be repeated four or five times with advantage. Breaking the tops should be done before fully ripe, or when the seed is a little past the milk; or if frost appears, then immediately after it. This is done by bending over the tops of the rows towards each other, for the convenience of cutting afterwards. They should be broken some 13 inches below the brush, and allowed to hang till fully ripe, when it may be cut and carried under cover, and spread till thoroughly dried. The stalks remaining on the ground may be cut close or pulled up and buried in the furrows for manure, or burnt, and thus be restored to the earth to enrich it; or they may be carried to the barn-yard to mix in a compost, or with the droppings of the cattle.

CLEANING THE BRUSH.—This is best done by hand, by passing it through a kind of hetchel, made by setting upright knives near enough together, or it may be cleaned by a long toothed currycomb. By the first method none of the little branches are broken, and the brush makes a finer, better broom. We have seen horse power machines used for cleaning the seed with great rapidity, in the Miami valley. The average yield is about 500 lbs. of brush per acre. It varies according to season and soil, from 300 to 1,000 lbs. The price also varies materially, ranging from 3 to 16 cents per lb.; the last seldom obtained unless in extreme scarcity. A good crop of seed is obtained in the Connecticut valley about

two years out of five. When well matured, the seed will average 3 to 5 lbs. for every pound of the brush. A single acre has produced 150 bushels seed, though 25 to 50 is a more common yield. It weighs about 50 lbs. per bushel, and is usually sold at 25 to 35 cents.

THE USES of broom corn are limited to the manufacture of brooms from the brush and the consumption of the seed when ground and mixed with other grain, in feeding to fattening or working cattle, sheep and swine, and occasionally to horses. Brooms manufactured from it, have superseded every other kind for general use in the United States, and within a few years they have become an article of extensive export to England and other countries. The brush and wood for the handles are imported separately to avoid high duties, and are there put together, and form a profitable branch of agricultural commerce to those hitherto engaged in the traffic. The cultivation of broom corn has, till quite recently, been almost exclusively confined to the north-eastern states; but it is now largely raised in the western states. Their fresh, rich soil, however, does not in general yield so fine, tough and desirable a brush as that grown in the older cultivated soils.

FLAX (*Linum usitatissimum.*)

This is one of the oldest cultivated plants of which we have any record; and its habitat or region of naturalization, extends from the torrid to the frigid zones. Its long silken fibres which come from the outer coating or bark of the stem, has been used for the manufacture of linen, from time immemorial. The absolute quantity at present grown, is probably equal to that of any preceeding age; but relatively, it is falling behind the product of cotton, which is rapidly on the increase. Flax is still a profitable crop, for in addition to its use as a material for clothing, the seed is of great value for its oil, and the food it yields to cattle, and for the latter purpose the whole plant is some times fed with decided advantage.

THE PROPER SOIL for flax, is a good alluvial or vegetable loam, equally removed from a loose sand or tenacious clay. In a very rich soil the fibre grows too coarse, and on a hard soil, the crop will not make a profitable return. Fresh barn yard manures are not suited to it and they should in all cases where necessary for a proper fertility, be added to the preceeding crop. A rich sod which has long lain in pasture or meadow, well plowed and rotted, is the best for it. Lime in

small quantities may be given to the soil, but the Flemings who raise flax extensively, never allow it to follow a heavy liming, till seven years intervene, as they consider it injures the fibre. A good wheat is generally a good flax soil. Salt, ashes and gypsum are proper manures for it; the last has the greatest effect if applied after the plant is developed and while covered with dew or moisture; all the saline manures used as a top-dressing benefit the plant and check the ravages of worms which frequently attack the young plants.

CULTURE on a finely prepared surface either of fresh sod, or after corn or roots which have been well cleared, sow broadcast, from sixteen to thirty quarts per acre if wanted for seed, or two bushels if wanted for the fibre. When thin it branches very much, and every sucker or branch is terminated by a boll well loaded with seed. When thickly sown, the stem grows single and without branches and gives a long, fine fibre. If the soil be very rich, and fibre is the object of cultivation, it may be sown at the rate of three bushels per acre. There is a great difference in seed, the heaviest is the best, and it should be of a bright brownish cast and oily to the touch. It should be lightly harrowed or brushed in and rolled. When three or four inches high, it may be carefully weeded by hand, and for this it is best to employ children, or if adults are put on the field they should be barefoot, and any depression of the plants by the feet will soon be recovered by the subsequent growth, which on good soil, will be sufficiently rapid to prevent the weeds again interfering with it. Grass seed or clover may be sown with flax without any detriment to it.

HARVESTING.—When it is designed for cambrics and the finest linen, flax is pulled when flowering; but in this country it is seldom harvested for the fibre till the seed is entirely formed, and although not ripe, most of it will mature if pulled, while the fibre is in its full strength. If required for seed, it should be left standing till the first seeds are well ripened. It is then gathered and bound in small bundles, and when properly dried is placed under cover. If it falls before ripening, it should be pulled at once, whatever be its stage of growth; as it is the only means of saving it.

AFTER MANAGEMENT.—The usual method of preparing flax in this country after removing the seed by drawing the heads through a comb or rake of finely set teeth, called rippling, is by dew-rotting, or spreading it thinly on a clean sward, and turning it occasionally till properly rotted, after

which it is put into bundles and stored till a convenient period for cleaning it. This is a wasteful practice and gives an inferior quality of fibre. The best plan of preparing it is by water-rotting, which is done in vats or small ponds of soft water, similar to those used for hemp. This gives a strong, even, rilky fibre and without waste, and worth much more either for sale or for manufacturing than the dew-rotted. Various steeps for macerating, and machines for preparing it have been used, which materially increases its marketable value. The fibre is generally got out on the *brake* by hand, when the farmer is most at leisure. A crop of the fibre may be estimated at 300 to 1000 lbs.; and of seed, from 15 to 30 bushels per acre.

There are no varieties worthy of particular notice, for ordinary cultivation. Great benefit is found to result from a frequent change of seed, to soils and situations differing from those where it has been raised. The seed is always valuable for the linseed oil it yields, and the residuum or oil cake stands deservedly high as a feed for all animals; and the entire seed when boiled, is among the most fattening substances which the farmer can use for animal food. Flax, like most other plants grown for seed, is an exhausting crop, but when pulled or harvested before the seed matures, it is not. The Flemings think flax ought not to be raised on thesame soil oftener than once in eight years.

HEMP (*cannasbis sativa*)

Is suited to large portions of our western soils and climate, and for many years, it has been a conspicuous object of agricultural attention. We have not yet brought the supply to our full consumption of it in its various manufactured forms, as we have till recently imported several millions annually. But the increased attention and skill bestowed on its cultivation, combined with our means for its indefinite production, will doubtless ere long constitute us one of the largest of the hemp-exporting countries.

THE SOIL for hemp may be similar to that for flax, but with a much wider range from a uniform standard, for it will thrive in moderately tenacious clay, if rich, drained, and well pulverized; and it will do equally well on reclaimed muck beds when properly treated. New land is not suited to it till after two or three years of cultivation. A grass sod or clover bed is best adapted to it when plowed in the fall or early in winter. This secures thorough pulverization by frost and

the destruction of insects, and especially the cut worm, which is very injurious to it. It should be re-plowed in the spring, if not already sufficiently mellow, as a fine tilth, considerable depth and great fertility are essential to its vigor.

Cultivation.—Early sowing produces the best crop, yet it should not be put in so early as to be exposed to severe frost; and where there is a large quantity planted, convenience in harvesting requires that it should ripen at sufficient intervals. The farmer may select his time for sowing, according to his latitude, and the quantity cultivated. From the 10th of April to 10th June is the fullest range allowed. The choice of seed is material, as it is important to have a full set of plants on the ground; yet an excess is injurious, as a part are necessarily smothered after absorbing the strength of the soil, and they are besides in the way of the harvesting, without contributing any thing to the value of the crop. Seed of the last year's growth is best, as it generally heats by being kept over, which can be avoided only by spreading thin. From four to six pecks per acre of good seed, is sufficient. The best is indicated by its weight and bright reddish color. It is usual to sow broadcast, and harrow in lightly both ways, and roll it. A smooth surface is material in facilitating the cutting. Sowing in drills, would require less seed, give an equal amount of crop, and materially expedite the planting. This should always be done before moist weather if possible, as rapid and uniform germination of the seed is thus more certainly secured. If the soil be very dry, it is better to place the seed deeper in the ground, which can be done with the shovel plow. If sown in drills and well covered, it might be previously soaked so as to secure early germination in the absence of rains.

Cutting.—"No after cultivation is necessary, and as soon as the blossoms turn a little yellow, and begin to drop their leaves, which usually happens 3 to 3 1-2 months after sowing, it is time to cut the hemp; if it stands, however, a week or ten days longer than this, no other detriment will ensue except that it will not rot so evenly, and becomes more laborious to break. Cutting is now almost universally practiced in preference to pulling. Not quite so much lint is saved by the first as by the last process, but the labor is pleasanter, and all subsequent operations, such as spreading out, stacking and rotting, are made easier. The lint also is of a better color and finer fibre, and the roots and stubble left in the ground and plowed under, tend to lighten the soil, and as

they decompose, become an equivalent to a light dressing of manure. If the hemp is not above seven feet high, it can be cut with cradle-scythes, similar to those used for wheat, (only larger and stronger,) at the rate of an acre per day; but if above this height, hooks must be used full three inches wide, of a corresponding thickness, and about two and a half feet long, something in the shape of a brush scythe or sickle, attached to the end of a long and nearly straight snath, and with these half an acre is considered a good day's work.

Drying and securing.—As fast as cut, spread the hemp on the ground where it was grown, taking care to keep the butts even, when if the weather be dry and warm, it will be cured in three days. As soon as sufficiently dried, commence binding into convenient sheaves, and if destined for water rotting, it ought to be transported to dry ground convenient to the pools, and then secured in round stacks, carefully thatched on the top to keep out the rain; but if designed for dew rotting, it should be secured in the same field where grown in large ricks. The reason why these are to be prefered is, that less of the hemp in them is exposed to the weather, and of course the more and better the lint when it comes to be rotted and broken out.

The Ricks should be 30 to 40 feet long, and 15 to 20 feet wide, the best foundation for which is large rails or logs laid down for the bottom course, six feet from each other, then lay across these, rails or poles one foot apart. As the hemp is bound in sheaves, let it be thrown into two rows, with sufficient space for a wagon to pass between. 'While the process of taking up and binding is going on, a wagon and three hands, two to pitch and one to load, is engaged in hauling the hemp to the rick, and stacking it. The rick should be in a central part so as to require the hemp to be removed as short a distance as possible. Thus the process of taking up, binding, hauling, and ricking, all progress together. In this way five hands will put up a stout rick in two days and cover it. By having two wagons and ten hands, it may be accomplished in one day. It is proper to remark, that for making the roof of the rick, it is necessary to have *long* hemp, from which the leaves should be beat off. *In this state only will hemp make a secure roof.*'—(*Beatty.*)

In laying down the hemp begin with the top ends of the bundle inside, and if they do not fill up fast enough to keep the inside of the rick level, add as occasion may require whole bundles. Give it a rounded elliptical form at each end,

and as it rises it must be widened so as to make the top courses shelter the bottom ones, and after getting up about twelve feet high, then commence for the roof, by laying the bundles crosswise, within a foot of the edges of the rick, building the top up roof-shaped, of a slope at an angle of about forty-five degrees. This finished, for the covering of the roof lay up the bundles at right angles to its length, the butt ends down, and the first course resting on the rim of the rick as left all around, one foot in width. Lap the bundles in covering the roof in courses, precisely as if shingling a house. The first shingling thus finished, commence the second by reversing the bundles, placing the top ends down, and then go on lapping them as before. The third course of shingling begin with the butt ends down again, letting the first course hang at least one foot below the edge of the roof, as eaves to shed off the rain well from the body of the stack. Unbind the bundles, and lay the covering at least one foot thick with the loose hemp, lapping well shingle fashion as before, and for a weather board, let the top course come up above the peak of the roof about three feet, and be then bent over it, towards that point of the compass from which the wind blows least. If the work has been faithfully performed, the rick may be considered as finished, and weather proof, and it requires no binding with poles or anything else. The rick should be made when the weather is settled and certain, for if rain falls upon it during the process, it will materially injure the hemp. There ought always to be a sufficient number of hands in the field to gather, bind the shocks, and finish the ricking in a single day.

Time of dew rotting.—The best time for spreading hemp for dew rotting, is in the month of December. 'It then receives what is called a winter rot, and makes the lint of the hemp a light color, and its quality better than if spread out early. But where a farmer has a large crop, it is desirable to have a part of his hemp ready to take up late in December, so that he may commence breaking in January. To accomplish this object, a part of his crop may be spread about the middle of October. It would not be prudent to spread earlier, as hemp will not obtain a good rot if spread out when the weather is warm. The experienced hemp-grower is at no loss to tell when hemp is sufficiently watered. A trial of a portion of it on the break will be the best test for those who have not had much experience. When sufficiently watered, the stalks of the hemp lose that hard, *sticky* ap-

pearance or feel, which they retain till the process is completed. The lint also begins to separate from the stalk, and the fibres will show themselves somewhat like the strings of a fiddle-bow attached to the stalk at two distant points, and separate in the middle. This is a sure indication that the hemp has a good rot.

SHOCKING AFTER BREAKING AND ROTTING.—When hemp is fit to be taken up, it should be immediately put in shocks, without binding, of suitable size. If it is dry, the shocks should be immediately tied with a hemp-band, by drawing the tops as closely together as possible, in order to prevent the rain from wetting the inside. If carefully put up and tied, they will turn rain completely. Each shock should be large enough to produce from fifty to sixty pounds of lint. If the hemp should be considerably damp, when taken up, the shocks should be left untied at the tops until they have time to dry. If shocks are not well put up, they are liable to blow down by a strong wind. To guard against this, it is desirable, when commencing a shock, to tie a band around the first armful or two that may be set up, and then raise up the parcel so tied, and beat it well against the ground so as to make it stand firmly, in a perpendicular direction. The balance of the shock should now be set regularly around the part as herein directed. If hemp be carefully shocked, it will receive little or no injury till the weather becomes warm. In the mean time it should be broke out as rapidly as possible. If the operation be completed by the middle of April, no material loss will be sustained. If delayed to a later period, more or less loss of lint will be the consequence. Cool, frosty weather is much the best for hemp-breaking. In that state of the weather, if the hemp is good, first-rate hands on the common hemp-break, will clean two hundred pounds per day upon an average. Two of my best hands, during the past season, for every day they broke, favorable and unfavorable, averaged one hundred and eighty-six pounds. Two others, who are young men and not full hands, averaged one hundred and forty-four pounds. The ordinary task for hands is one hundred pounds.'—*Beatty.*

HEMP BREAK.—The hand hemp-break is made precisely like that for flax, only much larger ; the under slats on the hinder end are 16 to 18 inches apart, at the fore-end they approach within three inches of each other. The slats in the upper jaw are so placed as to break joints into the lower

one, as it is brought down on to the hemp. It is a machine so common, however, that we deem further description unnecessary. After breaking out the hemp, it is twisted into bunches, and sent to the press-house to be baled, and is then transported to market."

WATER ROTTING.—"We think the best plan for water rotting is in vats under cover, the water in which is kept at an equable temperature. The hemp thus gets a perfect rot at all seasons of the year, in seven or ten days, and when dried, is of a bright, greenish, flaxen color, and is considered by many, of a better quality, and appears as handsomely as the finest Russian, and brings as high a price in market. These vats may be easily constructed and managed, and if built in a central position, by a company of planters on joint account, they would be but of small expense to each, and all in turn could be accommodated by them. The hemp is first broken in a machine, which is moved by steam power, previous to rotting, this lessens the bulk greatly, by ridding it of most of its woody fibre; but the process is not essential to rotting in vats, and can be dispensed with where the machines do not exist. If to be rotted in spring or river water, artificial pools or vats must be formed for this purpose, and should not be over three feet deep, otherwise the hemp is liable to an unequal rot. It will require plank placed upon it weighted down with timbers or stones, in order to keep it well under water. Mr. Myerle recommends vats 40 feet long. 20 feet wide, and 2 feet deep, as best and the most convenient for the season, that the hemp is kept cleaner while rotting, and the hands can lay it down in the vats and take it out without getting wet, which is very important to the health of the laborer. These vats also greatly facilitate the operation, and can be fed with water and have it run off at pleasure, without endangering loss from the hemp. Water rotting in streams, requires a longer or shorter period, according to the season. In September, when the water is warm, ten days is generally sufficient; in October, about fifteen, and in December, thirty days or more. For the latitude of Kentucky, October and November are considered the best months for the operation, and perhaps is easiest done, gives more lint, and upon the whole, as good a sample as if deferred later." —(*American Agriculturist.*)

RAISING HEMP SEED.—It is important that the farmer should be supplied with good seed, which is free from weeds, and this he can only be certain of when he produces it, him-

self. This requires another system of cultivation, but similar soil, which should be the in finest condition as to fertility and pulverization. An old pasture or meadow heavily manured and plowed in the fall and well pulverized in the spring furnishes the best soil. We again quote from Judge Beatty's valuable essays on practical agriculture:

"The seed should be planted as we do corn, either in hills or drills. I prefer the former, because it admits of easier and better cultivation, as the plow can be used both ways. It is usual to plant five feet apart, each way, and suffer four or five stalks to stand in a hill until the blossom hemp is removed, and then reduce the number so as not to exceed two stalks in a hill. Thus there would be two seed plants for each twenty-five square feet. It would be a better practice to make the hills three feet six inches apart, each way, and thin the hemp to three stalks in a hill, till the blossom hemp appears, and at the proper time cut out the blossom or male hemp; and, if necessary, a part of the seed hemp, so as to reduce the latter to one stalk in the hill. If each hill should contain *one stalk*, there would be two seed stalks for each twenty-four and a half square feet. This will give a greater number of *seed stalks* per acre than planting five feet each way, and leaving two in a hill. According to this plan, each seed plant will stand by itself, and, having its appropriate space of ground, can spread its branches without obstruction. According to the other plan, two seed plants, standing together, will obstruct each other, in putting forth lateral branches, and can scarcely be expected to produce *twice* as much as the single stalk.

"The ground for hemp seed, having been well prepared by at least two plowings, and a number of harrowings, sufficient to pulverize the ground, it should be laid off as above directed, and planted in the same manner as corn, except that the seed need not be covered more than an inch and a half deep. Thelve or fifteen seed should be dropped in each hill, which should be somewhat scattered to prevent them from being too much crowded in the hill. Though good hemp seed is certain to come up, yet it is prudent to plant about the number suggested to guard against casualties. Soon after the hemp seed comes up, a small shovel plough should be run through, both ways, once in a row. If the ground is not foul, the ploughing may be delayed till the hemp is a few inches high, which will enable the plowman to avoid throwing the dirt on the tender plants. The hoes should follow the

second plowing, and clean away the weeds, if any, in or near the hill, and thin out the hemp to seven or eight stalks. These should be the most thrifty plants, and somewhat separated from each other. The plowing should be repeated from time to time, so as to keep the ground light and free from weeds. And when the plants are about a foot or a foot and a half high, the hoes should again go over the ground and carefully cut down any weeds or grass which may have escaped the plow. The plants should be still further thinned out, at this time, leaving but four in a hill, and some fine mold drawn around the plants, so as to cover any small weeds that may have come up around them. After seed hemp has attained the height of a foot and a half, it will soon be too large to plow, but it ought to have one plowing after the last hoeing. The ground, by this time, will have become so much shaded by the hemp plants as to prevent the weeds from growing, so as to do any injury, and nothing more need to be done but for a boy to follow the plow, and (if three and a half feet be the distance of the hills apart,) reduce the number of plants invariably to *three*, taking care to remove those which the last plowing may have broken or injured, by the treading of the horse or otherwise. The next operation will be to cut out the blossom or male hemp. This, according to the opinion of some farmers, should be done as soon as the blossom begins to show, in order to make room for the seed hemp to grow and spread its branches. This opinion must be taken with some allowance. The farina or pollen of the male hemp is necessary to fertilize the seed bearing plants. The seed of the latter would be wholly unproductive, if the *whole* of the male hemp should be cut before its pollen has been thrown out. It is important to cut the male hemp so soon as it has performed its office, because much room is thereby afforded to the seed bearing plants to spread their branches.

"When the seed hemp has so far advanced as readily to distinguish the male from the female plants let all the blossom hemp be cut out, except one stalk in every other hill, and every other row. This would leave one stalk of male hemp for every four hills. These, together with the stalks which should thereafter blossom, would be sufficient to fertilize all the seed bearing plants, and secure a crop of *perfect* seed.— After the blossom plants, thus left, have been permitted to remain until they have pretty well discharged their pollen (which can be easily ascertained by dust ceasing to flow from

them when agitated) they, also, should be cut down. Some farmers top the seed plants, when five or six feet high, to make them branch more freely, but this is not necessary where but one or two seed bearing plants are suffered to remain in each hill."

A seed bearing hemp crop is a great exhauster of land, while such as is grown only for the fibre takes but a moderate amount of fertilizing matter from the soil. Unlike most crops sown broadcast, it grows with such strength and luxuriance, as to keep the weeds completely smothered, and it may therefore be grown for many successive seasons on the same field. Its entire monopoly of the ground, prevents the growth of clover or the grains in connexion with it.

The seed yields an oil of inferior value, and when cooked, it affords a fattening food for animals.

COTTON (*Gossypium.*)

Has, within the few past years, become the leading agricultural export of the United States. The total amount of the cotton crop in this country in 1845, was estimated at about 850,000,000 lbs. This enormous product has mainly grown up within the last 60 years. Even as late as 1825 our total production was within 170,000,000. The introduction of Whitney's cotton gin, in the latter part of the last century gave the first decided movement towards the growth of American cotton. Previous to this invention the separating of the cotton seed from the fibre was mostly done by hand, and the process was so slow and expensive as to prevent any successful competition with the foreign article. This incomparable invention, which cleaned 1000 lbs in the same time a single pound could be cleaned without it, overcame the only obstacle to complete success, and millions of acres of the fertile lands of the south and west are now annually covered with the snowy product. The increase seems to know no check or abatement, as with the lessening price and increasing quantity, the demand seems constantly to augment.

Climate and Soil.—Cotton will grow in some of the middle states, but with little profit north of the Carolinas and Tennesee. The soil required is a dry, rich loam.

Cultivation.—During the winter, the land intended for planting should be thrown up in beds by turning several fui rows together. These beds should be 4 feet from centre to centre for a moderate quality of upland soil, and 5 feet for the lowland. But these distances should be increased with

the increasing strength of the soil to 7 and 8 feet for the strongest lands. These may lie until the time of planting, from 20th of March to 20th of April, when no further danger from frost is apprehended; then harrow thoroughly and with a light plow mark the centre of the beds and sow at the rate of 2 to 5 bushels of seed per acre. A drilling machine might be made to answer this purpose better and save much time. An abundance of seed is necessary to provide for the enemies of the plant, which are frequently very destructive. If all the seed germinates, there will be a large surplus of plants, which must be removed by thinning. The kind of useed sed for uplands is Mexican and Petit-Gulf, both of the same variety, but the last is better selected and has been kept pure.—There is an advantage in mixing the seed before it is sown, with moistened ashes or gypsum, as it facilitates sowing and germination. The seed should be buried from ½ to 1½ inches, and the earth pressed closely over it. The subsequent cultivation is performed with various instruments, the bull-tongue or scooter, the shovel, double shovel, the sweep, the harrow, the cultivator and the hoe. One or more of the former must be used to pulverize the land and uproot and clean off the weeds; while the last is necessary to carry this operation directly up to the stem of the plants. The culture is thus summarily stated by Dr. Phillips: "Commence clearing the cotton early; clean it well; return to it as soon as possible, throw earth or mould to the young plants, and if the ground be hard give it a thorough plowing; keep the earth light and mellow and the plants clear of grass and weeds." The plants are thinned at every hoeing, till they attain a height of 3 or four inches, when two or three are allowed to stand together at intervals of about 8 inches for a medium quality of soil. This distance should be largely increased when it is richer. Cotton is subject to the cut and army worm, the slug and catterpillar, cotton lice, rot, sore shin and rust. We have seen no remedies prescribed for either, but we suggest for experiment the exposure of the two former to frost, by plowing just before its appearance. The free use of lime and salt and similar manures might arrest or mitigate the effects of all. Birds should also be encouraged upon the fields,as they would destroy numbers of the worm and insect tribes. It has been claimed that the introduction of the Mexican and Petit-Gulf varieties is the most effectual remedy, as they furnish hardier kinds, which are less the object of attack and have a greater ability to withstand it.

Harvesting is commenced when the bolls have begun to expand and the cotton is protruded, and this is continued from time to time as the bolls successively ripen and burst their capsules. It is done entirely by hand, the picker passing between two rows and gleaning from each. The cotton is placed in a bag capable of containing 15 or 20 lbs. which is hung upon his shoulders or strapped upon his breast.—These are emptied into large baskets which are taken, when filled, to the gin-house. We quote again from Dr. Philips: "Having all things ready for picking cotton, I commence as usual early, as soon as the hands can gather even 20 lbs. each. This is advisable, not only in saving a portion of that from being destroyed, if rains should fall, which often do at this season (about the middle of August,) but for another reason; passing through the cotton has a tendency to open out to sun and air the limbs that have interlocked across the rows, and hastens the early opening. On low grounds, especially, much loss is incurred in some seasons from the want of the sun to cause an expansion of the fibre within the boll, so as to cause it to open. The boll is composed of five divisions, in each of which there is a parcel of cotton wool surrounding each seed, there being several in each *lock* of cotton. When green, these fibres lie close to the seed, and as it ripens, the fibres become elastic, the boll becoming hard and brownish. The Sea Island has only three divisions, as also the Egyptian, which is only the Sea Island of the best variety, with black seed, smooth, and a yellowish tuft of fibres on the small end; they are both from Pernambuco. Some of the cotton we plant has only four divisions, but I think five generally. There is a peculiar art in gathering the cotton from the boll, which, like handling stock, can only be acquired by practice; many gather equally fast with either hand. The left hand seizes the stem near the open boll, or the boll between the two middle fingers, the palm of the hand up; the fingers of the right hand are inserted tolerably low down in the boll, a finger on each lock of cotton; then, as the fingers grasp it, there is a slight twisting motion, and a quick pull, which, if done well, will extract the contents, the boll being open, and the bottom of the locks not gummy to adhere. There is a vast difference in hands—not the quickest making the best pickers—a steady, clocklike motion, with some quickness, is necessary to gather fast. A neighbor of mine, when a young man, some ten years since, gathered 400 lbs., which was at that time the best I had known; this has been

beaten since, by aiding the hand in emptying his sacks, and almost feeding and watering him while at work."

"Cotton should be gathered from the field as clean as possible, taken to the scaffolds and dried until the seed will crack when pressed between the teeth, not crush or mash, but crack with some noise. It should be frequently turned over and stirred (all the trash and rotten pods taken out while this is being done,) so as to insure its drying earlier.

If seeds are wanted for planting, gin the cotton immediately, and spread the seed over the floor some five inches thick, until perfectly dry. If the cotton-seed be not wanted, pack the seed-cotton away into the house, to remain until a gentle heat is discovered, or until sufficient for ginning; after it has heated until a feeling of warmth to the hand, and it looks as if pressed together, open out and scatter to cool. This cotton will gin faster, have a softer feel, is not so brittle, therefore not so liable to break by rapidity of gin, and has a creamy color; the wool has imbibed a part of the oil that has exuded by the warmth of seed, and is in fact restored to the original color; for the oil being vegetable, it is dissipated by sun and air, and the color by moisture (of rain and dews) and light. I have known of a number of sales made of this description of cotton, and even those who are most strenuous against the heating, admit it bore a better price." The cotton is then ginned and baled, when it is ready for market.

Topping Cotton between the 20th July and 20th August is practised by many planters with decided success. It is thought by the foregoing authority, highly beneficial in dry seasons, but not in wet, and that in three years out of five it is attended with particular advantage to the crop.

Sea Island Cotton requires in many respects a treatment unlike that of the upland. We insert an article by Thomas Spalding, Esq. who has long been engaged in its cultivation.

"The Sea-Island cotton was introduced into Georgia from the Bahamas; the seed was from a small island near St. Domingo, known as Arguilla, then producing the best cotton of the western world. It in no way resembles the Brazil cotton which is the kidney-seed kind, introduced some years later, and which after trial, was rejected in Georgia. This seed came in small parcels from the Bahamas in the winter of 1785. It gradually and slowly made its way along the coast of Georgia, and passed into Carolina, from the year 1790, to 1792. The winter of 1786 in Georgia was a mild

one, and although the plants of the Sea-Island cotton that year had not ripened their seed; it being a perennial, and subject only to be killed by frost, it started the next season (1787) from the roots of the previous year, its seed ripened, and the plants became acclimated. Many changes have come over this seed since that time from difference of soil, of culture, and local position; and above all, from careful selection of seed. But it requires to be discovered, that what is gained in fineness of wool, is lost in the quality and weight of the product; for in spite of a zeal and intelligence brought to act upon the subject without parallel, the crops are yearly diminishing; until to grow Sea-Island cotton is one of the most profitless pursuits within the limits of the United States.

"The Culture.—When the Sea-Island cotton-seed was introduced in 1786, it was planted in hills prepared upon the level field, at five feet each way; but it was soon learned, that of all plants that grow, it is in its first vegetation and early stage the most tender; liable to suffer by storms, by wind, by drought, and by excess of rain. The quantity of seed was therefore increased, and the plants multiplied, until, as in most other cases, one extreme produced another. For many years, however, among experienced planters, the course is to divide their enclosed fields, into two portions; the one at rest, the other in culture.

"Preparing the Land for the Crop.—Early in February, any hands not engaged in preparing the previous crop for market, are employed in cleaning up the rested fields, and either in burning off the fennel-weeds and grass of the previous year, or in listing them in at five feet apart, to serve as the base of the future ridges or bed. There is much difference of opinion, upon the subject of burning or listing in; for myself, I am inclined to take the first opinion, believing that the light dressing of ashes the field receives from burning off, is more beneficial to the soil than the decay of the vegetable matter, and renders it less liable to produce what is a growing evil, the rust, a species of blight, much resembling the rust or blight upon wheat, and which takes place about the same period, just as the plant is putting out and preparing to ripen its fruit.

"Ridging.—The land being listed in short lines across the entire field, at five feet apart, the operation of ridging is commenced about the first of March. The ridges occupy

the entire surface; that is, the foot of one ridge commencing where the other ridge ends, and rising about eight inches above the natural level of the land, thus presenting a surface almost as smooth, and almost as deeply worked as a garden-bed. This ridging is carried on but a few days ahead of the planting. The ridge, if the operation has been carefully done, is from 2 to 2½ feet broad at top; it is then trenched on the upper surface with the hoe, six inches wide, and from three to six inches deep, depending upon the period of planting.

"PLANTING.—In the beginning, if the seed is covered more than two inches with soil, the soil will not feel the inflence of the sun, and the seed will not vegetate later; that is, in April up to the first of May, you must give from three to four inches of covering to preserve the moisture, or there, too, you fail from an opposite cause, the wind and burning influence of the sun drying the soil too much for vegetation. In most countries, after sowing the seed the roller is applied; but in cotton planting, in our ridge-husbandry, the foot in covering the seed and pressing down the earth well supplies its place.

"QUANTITY OF SEED PER ACRE.—A bushel of seed is generally sown to the acre, I believe half a bushel is better; for where the evil comes, whether the worm, or wind, or drought, or wet, there is no security in the many; but on the contrary, where they come up thin, they soon grow out of the way of injury from any enemy.

"AFTER-CULTURE.—The cultivation of Sea-Island cotton is carried on by the hand-hoe, and the quantity always limited to four acres to the laborer. The operation of weeding commences as soon as we finish planting, because in our flat and sandy soils the grass-seed springs with the first growth of the cotton, and by the time we finish planting, say the first of May, what we planted in March requires the hoe. The land is kept in the operation of hoeing and weeding as far as may be, at its original level, the beds neither increased or diminished, that rains which generally fall with beating power, and in redundant quantity, in the month of August, may as little as possible injure the growing plants, which are then in full bearing. The young cotton is thinned out slowly at from six to twelve inches apart on the ridge, by the 10th of June. As soon as the rains commence, which is about the last of July, it is wise to leave

nature to herself, and no longer disturb the soil; four hoeings if well done, and the grass well well picked at each hoeing, is enough; nor does any aftergrowth of grass do injury.

"MANURES AND SOILING STOCK.—For ten years past, great efforts have been made by the Sea-Island planters, in manuring. Much of the alluvion of our salt rivers have been collected, and sometimes placed directly in heaps through the fields at rest, at other times placed in cattle-pens, on which cotton-seed, and all waste materials are strewn, and the cattle pounded up on it. But what is preferred, is to pen our cattle near the river at night, and cut salt-grass, which covers these alluvion lands, and which is as nutritious as so much clover. Great benefits will result from the use of marl, I have no doubt, hereafter.

"AMOUNT OF CROP PER ACRE AND PICKING.—It has been stated already, that 500 lbs. to the acre is about the medium crop, which at 20 cents per lb., (more than the actual price for the last three years,) is to the planter $100 for gross crop; and from this hundred dollars is to be subtracted bagging, freight, expenses of sale, clothing for his people, medical attention, and too often provisions."

THE VARIETIES which have been cultivated with success in the United States, in addition to those enumerated, are *the Rio*, with a staple about three inches in length of a glossy, silky texture, brought from South America; *the Egyptian*, received from the garden of Mehemet Ali and grown in Louisiana 15 feet in height; *the Mastodon*, lately introduced from Mexico, firm in texture and highly productive; *the Chinese Silk Cotton*, white, soft, fine and silky; *the East India*, growing to a height of 14 feet and producing a beautiful fibre; and *the Nankeen*, a handsome staple of a true nankeen color, raised by the late Hon. John Forsyth of Georgia, and some other planters.

COTTON SEED.—The amount of seed in cotton is large, being nearly 70 per cent. of the entire gathering, the fibre being about 28. This is used for various purposes. Sometimes it is pressed for its oil, of which it yields from 15 to 20 per cent. of its own weight. When thus treated, the cake is used for cattle food. The seed is frequently though improperly fed raw to stock, and this often proves fatal especially to swine, besides being attended with much waste. It is most advantageously prepared by boiling for half an hour,

when it will benefit all descriptions of stock. By adding an equal quantity of corn and boiling them together it will fatten swine rapidly. It is also useful to land as a manure.

THE SUGAR CANE (*Saccharum officinarum.*)

The cultivation of the cane is an important branch of Southern agriculture. Its first introduction into this country, is said to have been in 1751, by some French jesuits, who planted it on the present site of New-Orleans. But it was not until between 1794 and 1800, when the revolution in St. Domingo sent hundreds of their planters into that state, that the growth of the cane became an object of decided importance. They brought with them the small yellow Creole, the only kind then cultivated in the French West India islands. From these limited and comparatively recent beginnings, the product has rapidly increased, until it has now become next to cotton, the great agricultural export from the Southern States. Over 160,000,000 lbs., with 9,000,000 gallons molasses, was the estimated crop for 1845. In Louisiana, the great sugar producing state, it has been cultivated almost exclusively on the low or rich level lands; but recently, the more elevated country has been used for it, and the experiments have been such as to justify the expectation that large quantities will hereafter be raised on the uplands. The cane was brought to Georgia in 1805 from the island of Otaheite. Its extension in some parts of that state and Florida was rapid, and while sugar commanded 10 cents per pound, it was a remunerating crop. Since its decline to five and six cents, the cultivation has diminished, but it is still largely raised for domestic consumption among the planters, and to some extent for exportation to the northern states.

Cultivation.—The first operation is to drain the land effectually with large open ditches, by which all the surface water is removed. The ground is then thoroughly prepared with the plough, and well harrowed if rough. "In Georgia," says Mr. Spalding, "the cane was cultivated differently from what it was elsewhere. It naturally took the course of our cotton culture of the seacoast; to wit, ridges at five feet apart; a trench was opened on the top of the ridge, three inches deep, in which a double row of cane-plants were placed, cut about two feet long, and placed so as the eyes which are alternate, should be on the sides, and then covered with two inches of earth. This you may suppose in a good season gives a continued line of stalks, not more than three inches

apart, and throwing up cane five or six feet fit for the mill. I have often supposed that there was growing of vegetable matter to the acre, from 30 to 40 tons, certainly containing more nutritious matter for stock, than any other plant would give upon the same surface. In Louisiana they planted altogether with the plow, and had their trenches not more than 2½ feet apart; they have since gradually widened their distance. When I was there, they used generally the old French plow, with a wheel at the end of the beam. With strong teams, they plowed deep and better than anywhere I had seen in the southern states. It was by means of the plow, that they planted so many acres to the laborer; and again, because they had little grass upon their river-lands except the nut-grass." The cane may be planted any time between the months of September and March; but is usually done in January and February after the sugar-making is completed. Some planters have recently obtained large crops by planting in rows at a distance of 8 feet apart. After the frost has disappeared, the earth is removed by the plow from each side of the cane, and the top earth is scraped off to prevent early vegetation. It is then kept clear of weeds and grass by the frequent use of the hoe, till it has produced suckers or shoots enough to afford a full stand. In the latter part of May or early in June it should be hilled about four inches, and then left unmolested till ready for the mill. The cane begins to ripen at the bottom in August or September and advances upwards at the rate of about six inches per week, and is usually fit for the mill by the middle of October.

Harvesting.—The cane is first topped while standing, which consists in cutting off the upper end of the stalk as far as the leaves are dry. The dry leaves are then stripped from the standing stalk, and the cane cut with a cane knife close to the ground, and carried in carts to the mill where it is at once passed through the rollers for expressing the juice. This last is immediately put into the kettles, boiled, skimmed, and reduced to the proper point for granulation or conversion into sugar. The tops and leaves are frequently left on the ground for manure, or used for stock feeding, and sometimes they are planted. But it is better to use the choicest whole cane for this purpose; and when thus selected, it is cut before frost and laid down in beds or *matelas* one or two feet in thicknes, with the tops overlapping and occupying the surface like shingles in a roof. Cane is generally planted in this country once in three years, and it con-

tinues to grow vigorously for this period from a single planting. In St. Domingo, many of the cane fields are irrigated from the mountain streams, by which the crop is largely increased, and the ratoons or old plants last for several years. Mr. Spalding places the average crop of the uplands in Georgia at 500 lbs. of sugar per acre, and that of the bottom or river lands, at 1000 lbs., while that of Louisiana is estimated at 800 lbs. The crushed cane is frequently used for fuel where wood is scarce. This is a wasteful custom as it is a valuable food for stock. Large quantities of the molasses have hertofore been used for distilling into alcohol, but the manufacture of this has materially lessened of late, and a salutary change has been made in its disposal. When it would not bring a remunerating price for exportation, as has sometimes been the case in the West Indies, it has been mixed with other materials and fed to stock. It is healthful and excedingly fattening to animals. Its great value for conversion into fat will be readily seen by comparing the elements of each. Sugar has been analyzed by several chemists with slightly varying results. According to the following authorities, it consists of

	Lussac & Thenard,	Berzelius,	Prout,	Ure,
Oxygen,	50.63	49.856	53.35	50.33 in 100
Carbon,	42.47	43.265	39.99	43.38 —
Hydrogen,	6.90	6.875	6.66	6.29 —

Fat according to Chevreul, consists of 79 carbon ; 11.4 hydrogen ; and 9.6 of oxygen. The only difference in the chemical character of molasses and sugar, is that the former contains a considsrable addition of water. Thus it will be seen, that fat and molasses are identical in their constituents though varying in their relative proportions ; and it would be fairly inferable from theory, as it has been found in practice, that no food is better suited to the easy and rapid conversion into animal fat if fed profusely.

THE VARIETIES of cane cultivated in the United States, are the *blue ribbon*, the stem of which is hadsomely striped with blue and yellow. These were brought from Jamaica, and are thus described by Mr. Spalding: "The first is so hardy, that I think it might be grown in warm, sandy soils, dressed with animal manures and with diluted ashes, even to New-York, for the feeding of cattle, and other useful purposes ; the cane for planting being placed in dry cellars, and only taken out for planting in warm days in April. The white striped cane is the tenderest of all the species, and in

our cold season of years past, has disappeared from among us—no loss, although a very soft cane, and easily expressed. The objection to the blue striped cane, it is very hard to grind, and really gives but little juice at best; it, however, grows higher, and is adapted to lower grounds, to moister soils, and shorter seasons, and the plants are much easier preserved for the next year. Light frost upon the cane improves the juice, and we have known the green cane upon Sapelo Island, for a few days, give juice that gave 13 by the hydrometer when three pounds of juice made a pound of sugar; no cane in Jamaica ever did more." The blue ribbon is the most prolific and most extensively cultivated variety on the rich lands of Louisiana. The Otaheite is largely raised, and with the Creole or Brazilian, (now nearly superseded,) makes up the cultivated varieties of the United States.

THE CANE COVERER recently invented by Mr. Bryan, it is affirmed will save a large amount of labor, a boy and span of horses covering with it 10 acres in a day, and it is equally efficient in removing the earth from the cane. *The hydraulic press* has been lately introduced for expressing the cane juice, which it does at the rate of 6000 gallons in every 10 hours, either by manual labor or with the aid of a couple of mules. The advantages claimed for it are numerous and striking. The *application of steam* to the manufacture of sugar, has been introduced into Louisiana quite recently, by Mr. Rielleux, by which 18,000 lbs. were made in 24 hours, with great economy and advantage.

MAPLE SUGAR.

The rock, hard or sugar maple tree (*Acer Saccharinum*) is among our most beautiful shade, and most valuable forest trees, and it stands next to the sugar cane in the readiness, and abundance with which it yields the material for *cane sugar*. When refined, there is no difference either in appearance or quality between the sugar from the cane, the maple or the beet. In the brown state, the condition in which it is sent to market, when made with care and formed into solid cakes, it retains its peculiar moisture and rich aromatic flavor, which makes it more acceptable to the nibblers of sweets, than the most refined and highly sented *bon-bons* of the confectioner. The quantity made in this country, is very large, though from the fact of its domestic consumption, and its seldom reaching the large markets, there is no estimate of the the aggregate production which will come very near the

truth. The product for Vermont alone, for 1845, was estimated at over 10,000,000 lbs. The quantity supposed to be annually sold in the city of New York, exceeds 10,000 hhds. Both the sugar and *syrup* are used for every purpose for which the cane is employed.

The sugar maple extends from the most northern limits of Maine and the shores of Lake Superior, to the banks of the Ohio. Further South it is rarely found. The cane and maple approach each other but scarcely meet, and never intermingle as rivals in the peculiar region which nature has assigned to each. In some sections of the country, the sugar maple usurps almost the entire soil, standing side by side, like thick ranks corn, yet large and lofty, and among the noblest specimens of the forest. The writer has thus repeatedly seen them around the Manitouwoc river, near the coast of Lake Michigan in Wisconsin, and in the beautiful *sugar orchards* of the same country, where unlike the others, they grow in open land among the rich native grasses, their tops graceful and bushy like the cultivated tree, and but for their greater numbers and extent and their more picturesque grouping, one would think the hand of taste and civilization had directed what nature alone has accomplished. And amid those beautiful orchards, or in the depths of those dense dark woods, the Indian wigwam and the settler's rude cabin may be seen, filled with the solid cakes and mokoks* which contain from 30 to 60 lbs. of their coarse-grained, luscious sugar.

The season for drawing and chrystalizing the sap is in early spring when the bright sunny days and clear frosty nights, give it a full and rapid circulation. The larger trees should be selected and tapped by an inch auger to the depth of an inch and a half, the hole inclining downward to hold the sap. At the base of this, another should be made from 3-8 to 1-2 an inch diameter, in which a tube of elder or sumach should be closely fitted to conduct it off. A rude contrivance for catching the sap is with troughs made usually of the easily wrought poplar, but it is better to use vessels which admit of thorough cleansing, and these may be suspended by a bail or handle from a peg driven into the tree above. If

*Mo-kok—An Indian sack or basket, with flattish sides and rounded ends, similar in fashion to a ladies travelling satchel. They are made perfectly tight, of strips of white birch bark, sewed with thongs of elm. They make some of their sap buckets of the same material, but different in form. The small mo-koks, tastefully ornamented with various colored porcupine quills and filled with maple sugar, are sold for toys.

nails are used, they may spoil the auger at some future tapping. When the sugar season is over, the holes ought to be closely plugged and the head cut off evenly with the bark which soon grows over the wound. If thus carefully managed, several may be made in a thrifty tree without any appearent injury to the tree. The barbarous, slovenly mode of half girdling the trunk with an axe, soon destroys it.

The sap is collected daily with buckets which are carried on the neck by a milk man's yoke to the boilers; or if the quantity be great and remote from the sugar fires, by a hogshead placed on a sled, with a large hole at the top covered with a cloth strainer, or a tunnel similarly guarded, is inserted in the bunghole. The primitive mode of arranging the sugary, is with large receiving troughs placed near the fires, capable of holding several hundred gallons of sap, and the boiling kettles suspended over them on long poles supported by crotches. *The process of sugar making* we shall give from the statement of Mr. Woodworth of Watertown, N. Y. who obtained the premium from the State agricultural society, for the best sample of maple sugar exhibited at the annual fair of 1844. The committe who awarded the premium say "they have never seen so fine a sample, either in the perfection of the granulation or in the extent to which the refining process has been carried; the whole coloring matter is extracted, and the peculiar flavor of maple sugar is completely eradicated, leaving the sugar fully equal to the *double* refined cane loaf sugar to be found in our markets."

The statement says: "in the first place I make my buckets, tubs, and kettles, all perfectly clean. I boil the sap in a potash kettle, set in an arch in such a manner that the edge of the kettle is defended all around from the fire. I boil through the day, taking care not to have any thing in the kettle that will give color to the sap, and to keep it well skimmed. At night I leave fire enough under the kettle to boil the sap nearly or quite to syrup by the next morning. I then take it out of the kettle and strain it through a flannel cloth into a tub, if it is sweet enough; if not, I put it in a caldron kettle, which I have hung on a pole in such a manner that I can swing it on and off the fire at pleasnre, and boil it till it is sweet enough, and then strain it into the tub and let it stand till the next morning; I then take it and the syrup in the kettle and put it altogether in the caldron and sugar it off. I use to clarify, say 100 lbs. of sugar, the whites of five or six eggs, well beaten, about one quart of new milk and a

spoonful of salæratus, all well mixed with syrup before it is scalding hot. I then make and keep a moderate fire directly under the caldron until the scum is all raised; then skim it off clean, taking care not to let it boil so as to rise in the kettle before I have done skimming it. I then sugar it off, leaving it so damp that it will drain a little. I let it remain in the kettle until it is well granulated. I then put it into boxes, made smallest at the bottom, that will hold from 50 to 70 lbs., having a thin piece of board fitted in two or three inches above the bottom, which is bored full of small holes to let the molasses drain through, which I keep drawn off by a tap through the bottom. I put on the top of the sugar in the box two or three thicknesses of clear damp cloth, and over that a board well fitted in so as to exclude the air from the sugar. After it has done or nearly done draining, I dissolve it and sugar it off again, going through the same process in clarifying and draining as before."

When sap is not immediately boiled, a small addition of lime water should be made to check fermentation, which prevents the granulation of the syrup. A single tree has yielded in one day, 24 gallons of sap, making over 7 1-4 lbs. of sugar; and in one season it made 33 lbs. Trees will give an average of 2 to 6 lbs. in a single season.

TOBACCO (*Nicotiana.*)

This narcotic is a native of North America and has been an object of extensive use and cultivatiou in this country since the first settlement of Virginia in the latter part of the 16th century. It formed for a long time the principal export from that colony and Maryland. It is still cultivated there and has become an object of considerable attention in the middle and western states and to some extent in the northern.

THE SOIL may be a light loamy sand, or it may be alluvial, well drained and fertile, new land free of weeds and full of saline matters is best suited to it, and next to this is a rich grass sod which has long remained untilled. The seed should be sown in beds which should be kept clean, as the plant is small and slow of growth in the early stages of its existence and is easily smothered by weeds. If not newly cleared, the land should be burned with a heavy coating of brush.

CULTIVATION—The beds should be well pulverized, and the seed sown at the rate of a table spoonful to every two square rods. The seeds are so minute, that sowing evenly is

scarcely attainable, unless by first mixing with 3 or 4 times its bulk of fine mold. This should be done sufficiently early to secure proper maturity to the plants in time for transplanting, (say by the last of February or early in March south of the Ohio, and about the first of April north of it,) covering lightly and completely rolling or treading down the earth.—The plant appears in 15 or 20 days and will be fit for transplanting in six or eight weeks. This should be done in damp weather, and the plants set singly, at a distance of 2½ to 3 feet each way. The after culture is like that of corn, and consists in frequently stiring the ground, with the plow or cultivator and hoe, and keeping down weeds. The places of such plants as fail, or are blighted, should be at once filled up, and all worms destroyed.

THE PRIMING, TOPPING AND SUCKERING are necessary operations. The first consists in breaking off four or five of the leaves next the ground which are valueless; the second is taking off the top to prevent the seed stalk from developing, and is regulated by the kind of tobacco. "The first topping will always admit of a greater number of leaves being left; and in proportion as the season advances, fewer leaves should be left. The heavier kinds of tobacco are generally topped early in the season, to twelve leaves, then to ten and still later to eight. The lighter kinds are topped to a greater number of leaves. If the soil is light, fewer leaves should be left," (*Beatty.*) Suckering consists in breaking off the young side shoots which should be done immediately after they make their appearance.

HARVESTING may be commenced with such plants as have become sufficiently ripe, which is indicated by greenish yellow spots on the leaves. This will generally occur in August at the south, and in September at the north. The stem of the plant is cut near the ground, and allowed to wilt, but not exposed to a hot sun. If there is danger of this, it should be cut only in the morning or evening, when properly wilted, which will be in a few hours, it may be carefully carried to the drying house, where it should be hung up by twine tied to the butt end of the stalk, and suspended over poles, at drying distances, with the head downwards. The circulation of air is necessary in the dry houses, but there must be entire safety against storms or winds, as the leaves are liable to break by agitation, and rain seriously injures them. When the stem in the leaf has become hard, it is suffiently dried. This takes place in good weather, in two or three months.—

The leaves may be stripped in damp weather, when they will not crumble, and carefully bound in small bundles, termed hands, and then boxed for shipment.

THE VARIETIES of tobacco are numerous, not less than 12 being cultivated in America, and they are adapted to the different soils and climates where they are grown. The most fragrant are produced in Cuba, and are almost exclusively used for cigars. They command several times the price of ordinary kinds. The tobacco of Maryland and the adjoining states is peculiarly rich and high flavored, and is most esteemed for chewing.

Much of the peculiar flavor and value of tobacco depends on the soil, and the preparation or sweating of the plant after drying. The former should not be too rich, and never highly manured, as the flavor is thereby materially injured though the product will be increased. Yet it is an exhausting crop, as is seen by the large quantity and the analysis of the ash, and the soil requires a constant renewal of well fermented manures, and particularly the saline ingredients, to prevent exhaustion. Tobacco contains nitrogen and the alkalies in large quantities, and but very little of the phosphates. The ash is shown in the analysis of Fresenius and Will, to consist, of potash, 30.67; lime, (mostly, with a little magnesia,) 33.36; gypsum 5.60; common salt, 5.95; phosphates, 6.03; silica, 18.39, in 100 parts of the ash. The inferior kinds contain a large proportion of lime; and the superior, the largest of potash. The customary method of burning fuel on the beds designed for tobacco, and the use of freshly cleared and burnt lands, by which the largest crops of the best quality are obtained, shows conclusively the proper treatment required. By each of these operations, the ground is not only loosened in the best possible manner, and all insects and weeds destroyed, but *the salts, and especially potash*, are produced in the greatest abundance. Some of the best soils in Virginia have been ruined by a constant succession of tobacco crops, the necessary result of neglect in supplying them with the constituents of fertility so largely abstracted. The yield per acre is generally from 1500 to 2500 lbs., and it is a profitable crop when the best kinds are properly cultivated, under favorable circumstances of soil, climate, &c. The total estimated product of the United States for 1843, was over 185,000,000. lbs. of which Kentucky furnished 52,000,000, and Virginia nearly 42,000,000 lbs. Missouri, Ohio, and other states are rapidly becoming large producers.

INDIDO (*Indigofera tinctoria*)

Was formerly cultivated at the South to a limited degree, but the introduction of cotton and the great profits which it yielded, and its consequent rapid extension, drove the culture of indigo on to foreign soils. But the decline in the price of cotton from large production and the increasing consumption of indigo in this country, together with the diminished price of other southern staples, will probably again make it an object of agricultural attention in those states where the soil and climate are suited to it. We have no detailed history of its cultivation in the United States, and we quote from Loudon. He says "it is one of the most profitable crops in Hindostan, because labor and land here are cheaper than any where else; and because the raising of the plant and its manufacture may be carried on without even the aid of a house. The first step in the culture of the plant is to render the ground, which should be friable and rich, perfectly free from weeds and dry, if naturally moist. The seeds are then sown in shallow drills about a foot apart. The rainy season must be chosen for sowing, otherwise, if the seed is deposited in dry soil, it heats, corrupts, and is lost. The crop being kept clear of weeds is fit for cutting in two or three months, and this may be repeated in rainy seasons every six weeks. The plants must not be allowed to come into flower, as the leaves in that case become dry and hard, and the indigo produced is of less value; nor must they be cut in dry weather, as they would not spring again. A crop generally lasts two years. Being cut, the herb is first steeped in a vat till it has become macerated, and has parted with its coloring matter; then the liquor is let off into another, in which it undergoes the peculiar process of beating, to cause the fecula to separate from the water. This fecula is let off into a third vat, where it remains some time, and is then strained through cloth bags, and evaporated in shallow wooden boxes placed in the shade. Before it is perfectly dry it is cut in small pieces of an inch square; it is then packed in barrels, or sowed up in sacks, for sale."

Indigo can only be raised to advantage in our most southern states. The soil requires to be dry, finely pulverized and rich. The seed is sown early in April, in drills about 18 inches apart, and the weeds are kept down by the hoe. It should be cut with a sickle or scythe, when the lower leaves begin to turn, and just before the plant is going into flower.

This period occurs in this country about the middle of summer. A second crop may be taken the first of autumn, and in hotter climates even a third one.

The Baton Rouge Advocate of 1844 says, an acre in that district will raise from 40 to 60 lbs. of indigo not inferior to the best Carraccas, selling at $2 per lb. It takes only from July to October to mature, and it does not demand one third of the time or expense for raising as that of a cotton crop. The consumption of indigo in this country already amounts to between two and three millions of dollars annually. *There are several varieties indigenous to the Southern States*, and one or more in the Northern which yield inferior dye.

MADDER (*Rubia tinctorum*)

Used for several dyes, but principally for the rich madder red, has been recently an object of attention in the United States. The introduction of this with numerous other articles consequent upon the extended growth of our manufactures, shows the intimate and mutually beneficial effects of associating the two leading industrial occupations of agriculture and manufactures. The principal cause which has prevented its cultivation among us thus far, has been the long time required for maturing a crop. We subjoin a description of its culture from Mr. Bateham.

Soil and preparation.—"The soil should be a deep, rich, sandy loam, free from weeds, roots, stones, &c., and containing a good portion of vegetable earth. Alluvial bottom land is the most suitable; but it must not be wet. If old upland is used, it should receive a heavy coating of vegetable earth, (from decayed wood and leaves.) The land should be plowed very deep in the fall, and early in the spring apply about one hundred loads of well rotted manure per acre, spread evenly, and plowed in deeply, then harrow till quite fine and free from lumps. Next, plow the land into beds four feet wide, leaving alleys between, three feet wide, then harrow the beds with a fine light harrow, or rake them by hand so as to leave them smooth, and even with the alleys; they are then ready for planting.

Preparing sets and planting.—Madder sets, or seed roots, are best selected when the crop is dug in the fall. The horizontal uppermost roots (with eyes) are the kind to be used; these should be separated from the bottom roots, and buried in sand, in a cellar or pit. If not done in the fall, the sets may be dug early in the spring, before they begin to

sprout. They should be cut or broken into pieces, containing from two to five eyes each; *i. e.* three to four inches long. The time for planting is as early in spring as the ground can be got in good order, and severe frosts are over, which, in this climate, is usually about the middle of April. With the beds prepared as directed, stretch a line lengthwise the bed, and with the corner of a hoe make a drill two inches deep along each edge and down the middle, so as to give three rows to each bed, about two feet apart. Into these drills drop the sets, ten inches apart, covering them two inches deep. Eight or ten bushels of sets are requisite for an acre.

After culture.—As soon as the madder plants can be seen, the ground should be carefully hoed, so as to destroy the weeds and not injure the plants; and the hoeing and weeding must be repeated as often as weeds make their appearance. If any of the sets have failed to grow, the vacancies should be filled by taking up parts of the strongest roots and transplanting them; this is best done in June. As soon as the madder plants are ten or twelve inches high, the tops are to be bent down on to the surface of the ground, and all except the tip end, covered with earth shoveled from the middle of the alleys. Bend the shoots outward and inward, in every direction, so as in time to fill all the vacant space on the beds, and about one foot on each side. After the first time covering, repeat the weeding when necessary, and run a single horse plow through the alleys several times to keep the earth clean and mellow. As soon as the plants again become ten or twelve inches high, bend down and cover them as before, repeating the operation as often as necessary, which is commonly three times the first season. The last time may be as late as September, or later if no frosts occur. By covering the tops in this manner, they change to roots, and the design is to fill the ground as full of roots as possible. When the vacant spaces are all full, there will be but little chance for weeds to grow; but all that appear must be pulled out.

The second year.—Keep the beds free from weeds; plow the alleys and cover the tops, as before directed, two or three times during the season. The alleys will now form deep and narrow ditches, and if it becomes difficult to obtain good earth for covering the tops, that operation may be omitted after the second time this season. Care should be taken, when covering the tops, to keep the edges of the beds as

high as the middle; otherwise the water from heavy showers will run off, and the crop suffer from drought.

THE THIRD YEAR.—Very little labor or attention is required. The plants will now cover the whole ground. If any weeds are seen, they must be pulled out; otherwise their roots will cause trouble when harvesting the madder. The crop is sometimes dug the third year; and if the soil and cultivation have been good, and the seasons warm and favorable, the madder will be of good quality; but generally, it is much better in quality, and more in quantity, when left until the fourth year.

DIGGING AND HARVESTING.—This should be done between the 20th of August and the 20th of September. Take a sharp shovel or shovels, and cut off and remove the tops with half an inch of the surface of the earth; then take a plow of the largest size, with a sharp coulter and a double team, and plow a furrow outward, beam-deep, around the edge of the bed; stir the earth with forks, and carefully pick out all the roots, removing the earth from the bottom of the furrow; then plow another furrow beam-deep, as before, and pick over and remove the earth in the same manner; thus proceeding until the whole is completed.

WASHING AND DRYING.—As soon as possible after digging, take the roots to some running stream to be washed. If there is no running stream convenient, it can be done at a pump. Take large, round sieves, two and a half or three feet in diameter, with the wire about as fine as wheat sieves; or if these cannot be had, get from a hardware store sufficient screen-wire of the right fineness, and make frames or boxes about two and a half feet long and the width of the wire, on the bottom of which nail the wire. In these sieves or boxes, put half a bushel of roots at a time and stir them about in the water, pulling the bunches apart so as to wash them clean; then, having a platform at hand, lay them on it to dry. (To make the platform, take two or three common boards, so as to be about four feet in width, and nail cleets across the under side.) On these spread the roots about two inches thick for drying in the sun. Carry the platforms to a convenient place, not far from the house, and place them side by side, in rows east and west, and with their ends north and south, leaving room to walk between the rows. Elevate the south ends of the platforms about eighteen inches, and the north ends about six inches from the ground, putting poles or sticks to support them—this will greatly facilitate drying.

After the second or third day drying, the madder must be protected from the dews at night, and from rain placing the platforms one upon another to a convenient height, and covering the uppermost one with boards. Spread them out again in the morning, or as soon as the danger is over. Five or six days of ordinarily fine weather will dry the madder sufficiently, when it may be put away till it is convenient to kiln-dry and grind it.

Kiln-drying.—The size and mode of constructing the kiln may be varied to suit circumstances. The following is a very cheap plan, and sufficient to dry one ton of roots at a time. Place four strong posts in the ground, twelve feet apart one way, and eighteen the other; the front two fourteen feet high, and the others eighteen; put girts across the bottom, middle and top; and nail boards perpendicularly on the outside as for a common barn. The boards must be well-seasoned, and all cracks or holes should be plastered or otherwise stopped up. Make a shed-roof of common boards. In the inside put upright standards about five feet apart, with cross-pieces, to support the scaffolding. The first cross-pieces to be four feet from the floor; the next two feet higher, and so on to the top. On these cross-pieces, lay small poles about six feet long and two inches thick, four or five inches apart. On these scaffolds the madder is to be spread nine inches thick. A floor is laid at the bottom, to keep all dry and clean. When the kiln is filled, take six or eight small kettles or hand furnaces, and place them four or five feet apart on the floor, (first securing it from fire with bricks or stones,) and make fires in them with charcoal, being careful not to make any of the fires so large as to scorch the madder over them. A person must be in constant attendance to watch and replenish the fires. The heat will ascend through the whole, and in ten or twelve hours it will all be sufficiently dried, which is known by its becoming brittle like pipe-stems.

Breaking and grinding.—Immediately after being dried, the madder must be taken to the barn and threshed with flails, or broken by machinery, (a mill might easily be constructed for this purpose,) so that it will feed in a common grist mill. If it is not broken and ground immediately, it will gather dampness so as to prevent its grinding freely. Any common grist-mill can grind madder properly. When ground finely it is fit for use, and may be packed in barrels like flour for market."

Mr. Swift of Ohio has raised 2000 bbls. per acre in one crop of four years growth, at a nett profit including all charges of rent &c., of $200 per acre. The roots of madder are also a good food for cattle, but the expense and delay of producing it unfit it for this use among us.

WOAD (*Isatis tinctoria*)

Is considerably used in this country for dyeing and generally as a base for blues, blacks and some other colors, and for these it supplies the place of indigo. There are several varieties of woad, but the common biennial plant is the only one cultivated. Loudon says—

"The soil for woad should be deep and perfectly fresh, such as those of the rich, mellow, loamy, and deep vegetable kind. Where this culture is carried to a considerable degree of perfection, the deep, rich, putrid, alluvial soils on the flat tracts extending upon the borders of the large rivers, are chiefly employed for the growth of this sort of crop; and it has been shown by repeated trials that it answers most perfectly when they are broken up for it immediately from a state of sward.

The preparation of the soil, when woad is to be grown on grass land, may either be effected by deep plowings, with the aid of the winter's frost, cross plowing and harrowing in spring; by deep plowing and harrowing in spring; by paring and burning; or by trench-plowing, or spade-trenching. The first mode appears the worst, as it is next to impossible to reduce old turf in one year, and, even if this is done, the danger from the grub and wire-worm is a sufficient argument against it. By plowing deep in February, and soon afterwards sowing, the plants may geminate before the grub is able to rise to the surface; by trench-plowing, the same purpose will be better attained; and, best of all, by spade-trenching. But a method equally effectual with the first, more expeditious, and more destructive to grubs, insects, and other vermin, which are apt to feed on the plants in their early growth, is that of paring and burning. This is, however, chiefly practised where the sward is rough and abounds with rushes, sedge, and other plants of the coarse kind, but it might be had recourse to on others, with benefit.

The mode of sowing is generally broad-cast, but the plant might be most advantageously grown in rows and cultivated with the horse-hoe. The rows may be nine inches or a foot apart, and the seed deposited two inches deep. The

quantity of seed for the broad-cast method is five or six lbs. to the acre; for the drill mode, two pounds are more than sufficient, the seed being smaller than that of the turnep. New seed, where it can be procured, should always be sown in preference to old; but, when of the latter kind, it should be steeped for sometime before it is put into the ground.—The time of sowing may be extended from February to July. Early sowing, however, is to be preferred, as in that case the plants come up stronger and afford more produce the first season. The after culture of the woad consists in hoeing, thinning, prong-stirring, and weeding, which operations may be practised by hand or horse tools, as in the culture of teazle.

Gathering the crops.—The leaves of the spring-sown plants will generally be ready towards the latter end of June or beginning of July, according to the nature of the soil, season and climate; the leaves of those put in at a later period in the summer are often fit to be gathered earlier. This business should, however, constantly be executed as soon as the leaves are fully grown, while they retain their perfect green color and are highly succulent; as when they are let remain till they begin to turn pale, much of their goodness is said to be expended, and they become less in quantity, and of an inferior quality for the purposes of the dyer. Where the lands are well managed they will often afford two or three gatherings, but the best cultivators seldom take more than two, which are sometimes mixed together in the manufacturing. It is necessary that the after-croppings, when they are taken, should be constantly kept separate from the others, as they would injure the whole if blended, and considerably diminish the value of the produce. It is said that the best method, where a third cropping is either wholly or partially made, is to keep it separate, forming it into an inferior kind of woad. In the execution of this sort of business, a number of baskets are usually provided in proportion to the extent of the crop, and into these the leaves are thrown as they are taken from the plants. The leaves are detached from the plants, by grasping them firmly with the hand, and giving them a sort of a sudden twist. In favorable seasons, where the soils are rich, the plants will often rise to the height of eight or ten inches; but in other circumstances, they seldom attain more than four or five.

The produce is mostly from about a ton to a ton and a half of green leaves. The price varies considerably; but for woad of the prime quality, it is often from twenty-five to thirty

pounds* the ton, and for that of an inferior quality six or seven, and sometimes much more.

To prepare it for the dyer, it is bruised by machinery to express the watery part; it is afterwards formed into balls and fermented, re-ground, and fermented in vats, where it is evaporated into cakes in the manner of indigo. The haulm is burned for manure or spread over the straw-yard, to be fermented along with straw-dung. To save seed, leave some of the plants undenuded of their leaves the second year, and when it is ripe, in July or August, treat it like turnep-seed.—The only diseases to which the woad is liable are the mildew and rust. When young it is often attacked by the fly, and the ground obliged to be resown, and this more than once even on winter-plowed grasslands."

WELD OR DYERS'S WEED. (*Reseda luteola.*)

Weld is much used by the manufacturers of various fabrics as a dye. It has not to our knowledge been cultivated in this country. We again quote from Loudon: "Weld is an imperfect biennial, with small fusiform roots, and a leafy stem from one to three feet in height. It is a native of Britain, flowers in June and July, and ripens its seeds in August and September. Its culture may be considered the same as that of woad, only being a smaller plant it is not thinned out to so great a distance. It has this advantage for the farmer over all other coloring plants, that it only requires to be taken up and dried, when it is fit for the dyer. It is, however, an exhausting crop.

Weld will grow on any soil, but fertile loams produce the best crops. The soil being brought to a fine tilth, the seed is sown in April or the beginning of May, generally broad-cast. The quantity of seed is from two quarts to a gallon per acre, and it should either be fresh, or, if two or three years old, steeped a few days in water previously to being sown. Being a biennial, and no advantage obtained from it the first year, it is sometimes sown with grain crops in the manner of clover, which, when the soil is in a very rich state, may answer, provided that hoeing, weeding and stirring take place as soon as the grain crop is cut. The best crops, however, will obviously be the result of drilling and cultivating the crop alone. The drills may be a foot asunder, and the plants thinned to six inches in the row. In the broad-cast mode, it is usual to

* The pound sterling may be reckoned at about $5.

thin them to six or eight inches' distance every way. Often, when weld succeeds grain crops, it is never either thinned, weeded, or hoed, but left to itself till the plants are in full blossom.

THE CROP IS TAKEN by pulling up the entire plant; and the proper period for this purpose is when the bloom has been produced the whole length of the stems, and the plants are just beginning to turn of a light or yellowish color; as in the beginning or middle of July in the second year. The plants are usually from one foot to two feet and a half in height. It is thought by some advantageous to pull it rather early, without waiting for the ripening of the seeds; as by this means there will not only be the greatest proportion of dye, but the land will be left at liberty for the reception of a crop of wheat or turneps; in this case, a small part must be left solely for the purpose of seed. In the execution of the work, the plants are drawn up by the roots in small handfuls; and after each handful had been tied up with one of the stalks, they are set up in fours in an an erect position, and left to dry. Sometimes, however, they become sufficiently dry by turning without being set up. After they have remained till fully dry, which is mostly effected in the course of a week or two, they are bound up into larger bundles, each containing sixty handfuls, and weighing fifty-six pounds.—Sixty of these bundles constitute a load, and in places where this kind of crop is much grown, are tied up by a string made for the purpose, which is sold under the title of weld-cord.

THE PRODUCE OF WELD depends much on the nature of the season; but from half a load to a load and a half per acre is the quantity most commonly afforded. It is usually sold to the dyers at from five or six to ten or twelve pounds the load, and sometimes at considerably more. It is mostly bought by persons who afterwards dispose of it to the dyers. The demand for it is sometimes very little, while at others it is so great as to raise the price to a high degree. It is sometimes gathered green and treated like woad or indigo; but in general the dried herb is used by the dyers in a state of decoction.

THE USE OF WELD in dyeing is for giving a yellow color to cotton, woollen, mohair, silk and linen. Blue cloths are dipped in a decoction of it, which renders them green; and the yellow color of the paint called Dutch pink is obtained from weld. To save seed, select a few of the largest and healthiest plants, and leave them to ripen. The seed is easily

separated. The chief disease of weld is the mildew, to which it is very liable when young, and this is the reason that it is often sown with other crops."

SUMACH. (*Rhus glabrum, R. coriaria and R. cotinus.*)

The Rhus Glabrum is the common sumach of the United States which grows spontaneously on fertile soils. It is considerably used by dyers, and the tanners of light leather. It is however much inferior to the R. Coriaria or Sicilian sumach, which is imported into this country from Spain, Portugal, Sicily, Syria and elsewhere, and sells at from $50 to $120 per ton. It is a dwarf, bushy shrub, smaller than the American, but with much larger leaves. These with the seed cones and young stems are all used by the manufacturers. The R. cotinus or Venice sumach, is the fringe tree or burning bush, a shrub for ornamental grounds, bearing a flossy, drab-colored blossom. It is known in England as young fustic, and is much used in the arts.

Cultivation and Treatment.—All the sumachs are propagated by layers, though it is probable they might, under favorable circumstances, be raised from the seed. On good soils they grow in great profusion. The harvesting consists simply in cutting off the young branches with the leaves and seed cones attached, in clear weather, drying them thoroughly without exposure to either rain or dew, and packing them in bales of about 160 lbs. for market.

The sumach is highly astringent, often taking the place of galls. This quality is much enhanced by warmth of climate; and the most valuable article is brought from the most southern regions. There is no doubt this species of plants might be cultivated with great profit in the southern states, and thus save the large amount annually expended in its importation, which is constantly increasing. The total importation is now estimated at between one and two millions of dollars per annum.

THE TEASEL OR FULLER'S THISTLE (*Dipsacus fullonum*)

Is another article exclusively used by the manufacturers, for the purpose of raising a nap, or combing out the fibres upon the dressed surface of woolen cloth or flannels. The consumption cannot of course be extensive, being limited exclusively to this demand. There is but one kind cultivated. A bastard variety of spontaneous growth exists in portions

of our middle states which resembles the useful teasel, with this peculiar difference, that the ends of the awns or chaff on the heads are straight instead of hooked, which renders them perfectly useless.

CULTIVATION.—The teasel is a biennial, requiring two years to mature. It is sown on a deep loamy clay, previously well plowed and harrowed, in drills 20 inches asunder, leaving a plant in every 10 inches, or in hills about 16 inches apart. The ground should be kept light by occasional stirring, and free from weeds. The plants are generally stronger and more thrifty if allowed to mature where sown, and to accomplish this, the intermediate spaces between the hills may be annually planted with new seed. Many adopt the plan of sowing in beds and transplanting.—Although hardy, there is sometimes an advantage in covering the beds which contain the young plants with straw during the winter.

GATHERING.—Those intended for use should be cut with a stem eight inches long below the head, just as it is going out of flower when the awns are the toughest; and as these come into maturity at different times in the same plant, they should be cut successively as they come forward. Those intended for seed, which should always be the largest, strongest heads, must be suffered to remain till ripe, when they can be gathered and threshed with the flail. The others should be thinly spread and dried under cover where no moisture can reach them. They may then be assorted into three parcels according to size and quality and packed in large sacks, when they are ready for market. The crop on good soils well cultivated, may be stated at 150,000 to 200,000 per acre, worth from $1.50 to $2.50 per 1000.

MUSTARD.

There are two species of mustard used for field cultivation; *the white* (*Sinapis alba*,) and *the black* (*S. nigra*,) the last of which is generally raised. It requires a rich loamy soil, deeply plowed and well harrowed. It may be sown, either broadcast, in drills about two feet apart, or in hills. Mr. Parmelee of Ohio thus raised on 27 acres, 23,850 lbs., which brought in the Philadelphia market, $2,908; an average of over $100 per acre. The ground on which it is planted must be frequently stirred, and kept clear of weeds. When matured, it should be carefully cut with the scythe

or sickle, and if so ripe as to shell, laid into a wagon box with tight canvass over the bottom and sides, so as to prevent waste. As soon as it is perfectly dry, it may be threshed and cleaned when it is ready for market.

The mustard is a valuable crop for green food for cattle or sheep, or for plowing in as a fertilizer. The following experiment was made by Mr. Gray in England in 1844, an account of which appears in the Journal of the Royal Agricultural Society. He says:—"The land on which it is growing is a thin stone-brash, and very poor. It had been manured, for turneps and rape, at the rate of 30 loads an acre, with compost, consisting of two-thirds lime and one-third road-earth; and, on the 10th of July, the turnep and rape-seed were drilled in with 80 bushels of ashes an acre. It came up slowly; and, with very few exceptions, was taken off by the fly. On the 28th of August I sowed 12 lbs. of *white* mustard-seed an acre, harrowing in the same. It was slow in coming up, from the dryness of the land; indeed, at one time I despaired of a crop, but when the rain fell it grew prodigiously; and on the 11th day of October I commenced feeding it. On an average it was then two feet high, and very thick in the ground; you will judge, from the specimen sent, of its present height—above 30 inches. I consider it a valuable artificial in sheep husbandry, and particularly so when turneps or rape fail; and, from its rapid growth, two, or even three crops may be taken and fed off in the season. From its great succulency, some care is required in feeding it off. Our sheep are doing well upon it; but I find they make better work, having an outlet every day on their walk, than when they were wholly confined upon it. Four hundred consume about a quarter of an acre a day, or thereabouts. One grew a most excellent piece of mustard last autumn, on some very heavy clay land, and without manure. His sheep being badly managed when feeding it off, he plowed in a considerable quantity for his wheat, of which he had a splendid crop, and certainly the best he grew last season. I mention this circumstance, believing it may be grown with success on either heavy or light soils. I was led to suppose it might be greatly affected by frosts, but we have experienced sufficient to destroy the potato-haulm and the dahlias, yet it has not in the slightest degree affected the mustard; I therefore conclude it must be severe to des-

troy it. The seed cost 14*s.* 6*d.* (about $3.65) per bushel, and weighed about 50 lbs. per bushel."

THE HOP, (*Humulus lupulus,*)

Of which there are several varieties indigenous to this country, is an important field crop. It grows best on a strong loam or well drained clay with a light sub-soil. If the latter be retentive of water, the hop will soon dwindle or die out. If made sufficiently rich, it will flourish on light loam or gravels, but a new, strong soil is better and this requires little or no manure. The most desirable exposure is a gentle slope to the south, but this should be where it can have a free circulation of air amidst the tall luxuriant vegetable growth.

CULTIVATION.—If the land has been long in use, it should be thoroughly dressed with compost and alkaline manures, or what is nearly equivalent, with fresh barn yard-manures on a previously well-hoed crop, made perfectly free of all weeds and deeply plowed and harrowed. Then mark out the ground at intervals of 6 feet each way and plant in the intersection of the furrows, and unless the ground be sufficiently rich, place 3 or 4 shovels of compost in each hill. The planting is done with the new roots taken from the old hills, which are laid bare by the plow. Each root should be 6 or 8 inches long and must contain two or more eyes, one to form the root and the other the vine. Six plants are put in a hill, all of which should be within the compass of about a foot, and covered to a depth of 5 inches, leaving the ground level when planted. The first season, the intermediate spaces between the hills may be planted with corn or potatoes, and the ground should be carefully cleared of weeds and frequently stirred. No poles are necessary the first year, as the product will not repay.—The ground should receive a heavy dressing of compost the following spring if not sufficiently rich and the plants should be well hoed and kept clean.

POLES may be prepared at the rate of 2 or 3 to each hill, 20 to 24 feet long and selected from a straight, smooth undergrowth of tough, durable wood from 4 to 7 inches diameter at the butt end. These are sharpened and firmly set with an iron bar, or socket bar with a wooden handle, in such a position as will allow the fullest effect of the sun upon the hills or roots.—When the plants have run to the length of 3 or 4 feet in the spring, they should be trained around the poles, winding in the direction of the sun's course, and fastened below the second or third set of leaves where there is sufficient strength of vine to

sustain themselves. They may be confined with rushes, tough grass, or more easily with wooolen yarn. This operation is needed again in a few days to secure such as may have got loose by the winds or other causes, and to train up the new shoots.

The gathering of hops should be when they have acquired a strong scent, at which time the seed becomes firm and brown and the lowest leaves begin to change color. This precedes the frosts in September. The vines must first be cut at the surface of the ground and the poles pulled up and laid in convenient piles, when they may be stripped of the hops, which are thrown into large, light baskets. Or the poles may be laid on long, slender boxes with handles at each end, (to admit of being carried by two persons,) and as the hops are stripped they fall into the box. But care must be taken that they be free from leaves, stems and dirt.

The hops should be hilled or covered with compost and all the vines removed in the fall. The following spring when the ground is dry, the surface is scraped from the hill, or additional compost is added, when a plow is run on four sides as near as possible without injury to the plants. All the running roots are laid bare and cut with a sharp knife within 2 or 3 inches of the main root and the latter are trimmed if spreading too far. It is well to break or twist down the first shoots and allow those which succeed to run, as they are likely to be more productive. Cutting should be avoided unless in a sunny day, as the profuse bleeding injures them. The poles will keep longer under cover.

Curing or drying.—This is an important operation and it may be done by spreading the hops thinly in the shade and stirring them often enough to prevent heating. But when there is a large quantity they can only be safely cured in a kiln. The following mode is recommended by Mr. Blanchard in the New England Farmer:

"Much depends on having a well-constructed kiln. For the convenience of putting the hops on the kiln, the side of a hill is generally chosen for its situation. Care should be taken that it be a dry situation. The kiln should be dug out the same bigness at the bottom as at the top; the side walls laid up perpendicularly, and filled in solid with stone, to give it a tunnel form. Twelve feet square at the top, two feet square at the bottom, and at least eight feet deep, is deemed a convenient size. On the top of the walls sills are laid, having joists let into them in like manner as for laying a floor; on which laths, about one and a half inches wide are

nailed, leaving open spaces between them three-fourths of an inch, over which a thin linen cloth is spread and nailed at the edges to the sills. A board about twelve inches wide is set up on each side of the kiln, on the inner edge of the sill, to form a bin to receive the hops. The larger the stones made use of in the construction of the kiln, the better; as it will give a more steady and dense heat. The inside of the kiln should be well plastured with mortar to make it completely air-tight. Charcoal (that made from yellow birch or maple I should prefer) is the only fuel proper to be used in drying hops. The kiln should be well heated before any hops are put on, and carefully attended, to keep a steady and regular heat. Fifty pounds of hops, when dried, is the largest quantity that should be dried at one time, on a kiln of this size; and unless absolutely necessary to put on that quantity, a less would dry better. The green hops should be spread as evenly and as light as possible over the kiln. The fire at first should be moderate, but it may be increased as the hops dry and the steam is evaporated. The hops, after laying a few days, will gather a partial moisture, called a sweat. The sweat will probably begin to subside in about eight days, at which time, and before the sweat is off, they ought to be bagged in clear dry weather. As the exact time when the hops will begin to sweat, and when the sweat will begin to subside or dry off, (the proper time to bag them,) will vary with the state of the atmosphere, it will be necessary to examine the hops from day to day, which is easily done by taking some of them from the centre of the heap with your hand. If on examination you find the hops to be very damp, and their color altering, which will be the case if they were not completely dried on the kiln, and not otherwise, you must overhaul them and dry them in the air. Hops should not remain long in the bin or bag after they are picked, as they will very soon heat and become insipid. The hops should *not* be stirred on the kiln until they are completely and fully dried. Then they should be removed from the kiln into a dry room, and laid in a heap, and there remain, unmoved and unstirred, until bagged, which is done with a screw, having a box made of plank, the size the bag is wished, into which the cloth is laid, and the hops screwed into the box, which is so constructed that the sides may be removed and the bag sewed together while in the press. The most convenient size for a bag of hops to handle and transport, is about five feet in length and to contain about two hundred and fifty pounds. The best

bagging is coarse, strong tow cloth, of our domestic manufacturing; next to that, Russia hemp bagging.

"It is now common for those who have entered considerably into the cultivation of hops, to build houses over their kilns, which, in wet weather, are very convenient; otherwise, a kiln in the open air would be preferable. It is necessary to have these buildings well ventilated with doors and windows; and to have them kept open night and day, except in wet weather, and then shut those only which are necessary to keep out the rain. If a ventilator was put in the roof of the building, directly over the centre of the kiln, about six feet square, built like those in breweries and distilleries, they would be found very advantageous. I have seen many lots of hops much injured both in color and flavor by being dried in close buildings. Where the houses over the kilns are built large, for the purpose of storing the hops as they are dried, which is a great saving of labor, a close partition should be made between the kilns and the room in which the hops are stored, to prevent the damp steam from the kilns coming to them, as it will color them, and injure their flavor and quality very much."

Diseases.—Hops are liable to attack from various insects, blight, mildew, &c. There is no effective remedy of general application for either. The best preventives are new or fresh soil which is rich in ashes and the inorganic manures, and in a fine tillable condition to insure a rapid growth, by which it may partially defy attack; and open planting on such positions as will secure free circulation of air. When properly managed, hops are one of the most productive crops, but their very limited use will always make them a minor object of cultivation.

THE CASTOR BEAN, (*Ricinus communis*, usually called *Palma Christi*,)

Is a native of the West India Islands, where it grows with great luxuriance. It is cultivated as a field crop in our middle states, and in the states bordering the Ohio river on the north. It likes a rich, mellow bed, and is planted and hoed like corn. It attains the height of 5 or 6 feet, and bears at the rate of 20 to 28 bushels per acre. The seed is separated from the pods, bruised and subjected to a great pressure, by which they yield near a gallon to the bushel of *cold pressed* castor oil, which is better than that extracted by boiling and skimming. The last is done either with or without first slightly

roasting. This oil forms not only a mild cathartic, but with some, is an article of food. Its separation into a limpid oil for machinery and lamps, and into stearine for candles, has lately much increased its valuable uses.

CHAPTER XII.

MISCELLANEOUS AIDS AND OBJECTS OF AGRICULTURE.

We have thus far treated of soils and manures, the preparation of the ground and the ordinary cultivated field crops, as fully as our limits will permit. It remains for us briefly to add such incidental aids and objects of agriculture as could not appropriately be embraced under either of the foregoing heads.

ROTATION OF CROPS, ITS USES AND EFFECTS.

The practice of rotation of crops is an agricultural improvement of very modern date. It is first mentioned in Dickson's Treatise on Agriculture, published in Edinburgh, in 1777.—Rotation has for more than a century been partially practised in Flanders and perhaps in some other highly cultivated countries, and it was afterwards introduced and imperfectly carried out on a limited scale in the Norfolk district in Great Britain; but its general introduction did not take place till the beginning of the present century. The system of rotation is one of the first and most important principles of general husbandry, and it cannot be omitted without manifest disadvantage and loss. The place of rotation was formerly supplied by *naked fallows.* This practice consists, as we have before shown, in giving the soil an occasional or periodical *rest,* in which no crop is taken off, and the soil is allowed to produce just what it pleases or nothing at all, for one or more years, when it is refreshed and invigorated for the production of its

accustomed useful crops. This system, it will be perceived, implies the loss of the income of the soil for a certain portion of the time, and it can be tolerated only where there is more land than can be cultivated. Modern agricultural science has detected, in part at least, the true theory of the necessity for rotation. It has been discovered that every crop robs the soil of a portion of its elements, (fifteen or sixteen elementary substances combined in various forms and proportions,) and that no two dissimilar crops abstract these elements or their compounds from the soil in the same proportions. Thus, if we consider the amount of the salts taken out of the soil by a crop of turneps amounting to 5 tons of roots per acre; of barley, 38 bushels; one ton each of dry clover or rye-grass; and of wheat, 25 bushels, we shall find the great disproportions of the various elements, which the different vegetables have appropriated. As given by Johnston they will be in pounds as follows:

	Turnep Roots.	BARLEY.		Red Clover.	Rye Grass.	WHEAT.		Total.
		Grain.	Straw.			Grain.	Straw.	
Potash . . .	145.5	5.6	4.5	45.0	28.5	3.3	0.6	233.0
Soda . . .	64.3	5.8	1.1	12.0	9.0	3.5	0.9	96.6
Lime . . .	45.8	2.1	12.9	63.0	16.5	1.5	7.2	149.0
Magnesia . .	15.5	3.6	1.8	7.5	2.0	1.5	1 0	32.9
Alumina . . .	2.2	0.5	3.4	0.3	0.8	0.4	2.7	10.3
Silica . . .	23.6	23.6	90.0	8.0	62.0	6.0	86.0	299.2
Sulphuric Acid	49.0	1.2	2.8	10.0	8.0	0.8	1.0	72.8
Phosphoric do.	22.4	4.2	3.7	15.0	0.6	0.6	5.0	51.5
Chlorine . . .	14.5	0.4	1.5	8.0	0.1	0.2	0.9	25.6
								970.9*

Besides the elements above noted, all crops absorb oxide of iron, and nearly all oxide of manganese and iodine; and of the organic elements associated in various combinations, they appropriate about 97 per cent of their entire dried weight. Now it is not only necessary that all the above materials exist in the soil, *but that they are also to be found in a form precisely adapted to the wants of the growing plant.* That they exist in every soil, in some conditions, to an amount large enough to afford the quantity required by the crop, can hardly be doubted, but that they are all in a form to supply the full demands of a luxuriant crop, is probably true of such only as are found, under favorable circumstances of season and climate, to have produced the largest burthens. If a succession of any given crops are gathered and carried off the land,

* This is exclusive of the turnep tops.

without the occasional addition of manures, they will be found gradually to diminish in quantity, till they reach a point when they will scarcely pay the expenses of cultivation. We mean to be understood as affirming this of all crops and all soils however naturally fertile the latter may be, unless they are such as receive an annual or occasional dressing from the overflow of enriching floods, or are artificially irrigated with water, which holds the necessary fertilizing matters in solution; and such are not exceptions, but receive their manure in another form, unaided by the hand of the husbandman. Neither are *old meadows* (mowing lands filled with the natural or uncultivated grasses or whatever of useful forage they choose to bear) exceptions to this rule, for though they may part with a portion of their annual crop in the hay, which is removed, and which is not returned as manure, and by a partial rest or pasturage appear to sustain their original fertility, yet if the true character of the various plants which they produce were accurately observed, (all of which are indiscriminately embraced under the general head of grass or hay,) it would be found that the plants gradually change from year to year; and while some predominate in one season, others take their place the year succeeding, and these again are supplanted by others in an unceasing round of natural rotation. Another illustration of rotation may be observed in the succession of forest trees that shoot up on the same soil, to supply the places of such of their predecessors as have decayed or been cut down. Thus the pine and other of the coniferæ, are frequently found to usurp the place of the oak, chesnut, and other deciduous trees. This occurs sometimes partially, but in repeated instances which have come within our notice, forests have been observed to pass entirely from one order of the vegetable creation to its remote opposite, the seeds or germs of which, (the product of an ancient rotation,) had been lying dormant for centuries perhaps, waiting a favorable condition of circumstances and soil to spring into life.

Many choice secondary bottom lands, and others munificently supplied by nature with all the materials of fertility, have by a long succession of crops been reduced to a condition of comparative sterility. Yet it will have been found in the progress of this exhaustion, that after the soil ceased to give an adequate return of one crop, as of wheat, corn or tobacco, it would still yield largely of some other genus which was adapted to it. These lands when thus reduced and turned out to commons for a few years, will again give crops much

larger than those which closed their former bearing career, proving that nature has been silently at work in renovating the land for further use. The whole course of her operations is not yet known, but this much is satisfactorily ascertained; that she is incessantly engaged in producing those changes in the soil, which enable it to contribute to vegetable sustenance. Enough of lime, or potash, or silica may have been disengaged to yield all that may be required for one crop, which by that crop is principally taken up, and if another of the same kind follows in quick succession, there will be a deficiency; yet if a different crop succeed, there may be found enough of all the materials it needs, fully to mature it. A third now takes its place demanding materials for nutrition in forms and proportions unlike either which has preceded it, and by the time a recurrence to the first is necessary, the soil may be in a condition again to yield a remunerating return. These remarks apply equally to such soils as have, and such as have not received manures; unless, as is seldom the case, an accurate science should add them in quantity and character, fully to supply the exhaustion. The addition or withholding of manures, only accelerates or retards this effect.

Another prominent advantage of rotation, is in its enabling such crops to have the benefit of manure, as cannot receive it without hazard or injury if applied directly upon them. Thus wheat and the other white grains, are liable to overgrowth of straw, rust, and mildew, if manured with recent dung; yet this is applied without risk to corn, roots and most of the hoed crops; and when tempered by one season's exhaustion, and the various changes and combinations which are effected in the soil, it safely ministers in profusion to all the wants of the smaller cereal grains. A third benefit of rotation is, by bringing the land into hoed crops at proper intervals, it clears it of any troublesome weeds which may infest it. And still a further advantage may be found, in cutting off the appropriate food of insects and worms, which in the course of time, by having a full supply of their necessary aliment, and especially if undisturbed in their quiet haunts, will ofttimes become so numerous as seriously to interfere with the labors of the farmer. A change of crops and exposure of the insects to frosts, and by the change of cultivation which a rotation insures, will make serious inroads upon their numbers if it does not effectually destroy them. The fanciful theory of the *noxious excretions of plants* first broached

and ingeniously defended by the powerful name of Decandolle, and which the closest scrutiny of scientific observers since, has pronounced unworthy of credit, does not form a fifth reason for rotation. It is because principles essential to successful vegetation have been abstracted, not that others hurtful to it have been added by preceding crops, that rotation is rendered necessary. From all that has hitherto been learned on the subject of rotation, either from science or practice, two general principles may be assumed as proper to guide every farmer in his course of cropping. First to cultivate as great a variety of plants as his soil, circumstances and market will justify; and second, to have the same or any similar species follow each other at intervals as remote as may be consistent with his interests. From the foregoing observations on the subject, it is evident that the proper system of rotation for any farmer to adopt, must depend on all the conditions by which he is surrounded, and that it should vary according to these varying circumstances.

It is a practice with some to alternate wheat and clover, giving only one year to the former and one or two years to the latter. This will answer for a long time on soils adapted to each crop, provided there be added to the clover, such manures as contribute to its own growth, and such also as are exhausted by wheat. The saline manures, ashes, lime, &c. may be added directly to the wheat without injury; but gypsum should be sown upon the clover, as its benefits are scarcely perceptible on wheat, while upon clover, they are of the greatest utility. But there are objections even to this, as it does not allow an economical or advantageous use of barnyard manures, which, from their combining all the elements of fertility, are the most certain in their general effect. In different countries of Europe, fields which have been used for an oft-recurring clover crop, have become *clover sick*, as it is familiarly termed. The plant will not grow luxuriantly; sometimes refusing to vegetate, or if it starts upon its vegetable existence, it does so apparently with the greatest reluctance and suffering, and ekes out a puny, thriftless career, unattended with a single advantage to its owner. This is simply the result of the exhaustion of one or more of the indispensable elements of the plant. If it be desirable to pursue this two-course system for any length of time, nothing short of the application of all such inorganic matters as are taken up by the crops, will sustain the land in a fertile condition. We subjoin simply for the purpose of

illustration, and the guidance of such as may have little experience in rotation, some systems which have been pursued with advantage in this country:

1°. On a grass sod broken up, with a heavy dressing of barn yard manure, and muck, ashes, and lime if necessary. First year, corn with gypsum scattered over the plants after the first hoeing, which should be immediately after its making its first appearance; second year, roots with manure; third year, wheat if adapted to the soil; if not, then barley, rye, or oats, with grass or clover seed or both; fourth year, meadow, which may be continued at pleasure, or till the grass or clover gives way. The meadow may be followed by pasturing if desired. Clover alone should not remain over two years as meadow, but for pasture it may be continued longer.

2°. First year, corn or roots on a grass or clover ley with manure; second, oats and clover, with a top dressing of 10 to 20 bushels of crushed bones per acre; third, clover pastured to last of June, then grown until fully matured in August, when it is turned over, and a light dressing of compost and 40 to 80 bushels of leached ashes spread over it, and wheat and timothy seed sown about 15th September. If desired, the following spring, clover is sown and lightly harrowed. This gives for the fourth year, wheat; fifth and sixth, and if the grass continues good, the seventh year also, meadow.

3°. First, corn on a grass sod heavily manured, and a half gill of ashes and gypsum mixed at the rate of two of the former to one of the latter put in the hill, and an equal quantity of pure gypsum added after the corn is first hoed; second, oats or barley, with lime at the rate of 20 or 30 bushels per acre, sown broad-cast after the oats and harrowed in; third, peas or beans, removed early, and afterwards sown with wheat; fourth, wheat with a light top dressing of compost, and saline manures in the spring, and clover, or grass and clover seed; fifth, two or three years in meadow and pasture.

4°. First, wheat on a grass sod; second, clover; third, Indian corn, heavily manured; fourth, barley or oats, with grass or clover seed; fifth, and following, grass or clover.

5°. A good rotation for light, sandy lands, is first, corn well manured and cut off early and removed from the ground, which is immediately sown with rye, or the rye hoed in between the hill; second, rye with clover sown in the spring, and gypsum added when fairly up; third, clover cut for hay,

or pastured, the latter being much more advantageous for the land.

WEEDS.

Whatever plants infest the farmer's grounds, and are worthless as objects of cultivation, are embraced under the general name of weeds. In a more comprehensive sense, all plants however useful they may be as distinct or separate objects of attention, when scattered through a crop of other useful plants to their manifest detriment may be considered and treated as such. Perfect cultivation consists in having nothing upon the ground but what is intended for the benefit of the farmer, and it implies a total destruction of every species of vegetation which does not contribute directly to his advantage.

In China and some parts of Flanders, the fields are entirely free from weeds. This is the result of long continued cleanly cultivation by which every weed has been extirpated; and a scrupulous attention to the purity of the seeds; and the sole use of urine, poudrette, and saline manures. This object is scarcely attainable in this country, except on fields peculiarly situated. The principal causes of the propagation of weeds among us, is the negligent system of tillage, and the use of unfermented vegetable manures. By heating or decomposition, all the seeds incorporated in the manure heap are destroyed. But there is a great loss in applying manure thus changed, and having parted with large portions of its active, nutritive gases, unless protected by a thick covering of turf or vegetable mold. For many soils and crops, undecomposed manures are far the most valuable. But they should always be applied to the hoed crops, and such as will receive the attention of the farmer for the utter extinction of weeds. A single weed which is allowed to mature, may become 500 the following year, and 10,000 the year after. The cleansing of land from weeds, is almost the sole justification for naked fallows. When a large crop of them have by any means obtained possession of the ground, they ought to be turned into the soil with the plow before ripening their seed, and they thus become a means of enriching rather than of impoverishing the ground. Meadows which have become foul with useless plants, may be turned into pasture; and if there are plants which cattle and horses will not eat, let them first crop it closely, and then follow with sheep, which are much more indiscriminate in their choice of food, and consume many

plants which are rejected by other animals. Whatever escapes the maw of sheep, should be extirpated by the hand or hoe before seeding. The utmost care, also, should be used in the selection of seed, and none sown but such as has been entirely freed from any foreign seeds.

The Canada thistle is the only weed which has taxed the ingenuity of vigilant farmers in effecting its removal. This is however within the power of every one, who will bestow upon it a watchful attention for a single season. The plant should be allowed to attain nearly its full growth, or till it comes into flower, when it has drawn largely upon the vitality of its roots. If the patch be large the plow should be used to turn every particle of the plant under the surface, and let the hoe or spade complete what has escaped the plow. If the patch be small, the hoe or spade should be used to cut off the crown of the root, and if in blossom, let the tops be burnt to prevent the possibility of any of the seeds ripening. As soon as the tops again make their appearance above ground, repeat the plowing or spading, and continue this till the middle of autumn, when the land will be free from them, and in fine condition to yield a crop of wheat. If they harbor in fences or walls, these should either be removed, or the thistle followed to its roots, and kept constantly cut into the ground, when it will not long survive.

FIBROUS COVERING OR GURNEYISM

Is the name given to the practice, (conspicuously brought into notice recently by Mr. Gurney of England,) of covering grass lands with straw or any simiiar vegetable matter. It has received the sanction of many eminent agriculturists abroad; and for the purpose of throwing every improvement before our readers which may possibly benefit them, we subjoin the following from an article on the subject, in the British Farmer's Magazine for 1845. "The fact of a remarkable increase of vegetation from fibrous covering has now been fully confirmed by numerous and careful experiments. In every instance where the relative quantities of grass were cut and weighed, that operated on by this agency showed an increase of six to one over that of other parts of the fields without manure, and of five to one above that where guano, farm-yard manure, wood ashes, or pigs'-house dung had been applied against it. The quantity of hay obtained from the grass was in the same ratio; the mean of the results from different farms, shows that a ton and a half was obtained

where Gurneyism had been used, and only from four to five cwt. where it had not. In many cases the grass was so slight on the parts of the fields not covered that it could with difficulty be mowed, and in some cases was considered not worth cutting at all. The question of quantity is indeed settled. The next question, viz: its comparative goodness, seems also determined. Mr. Gurney at former meetings gave it as his opinion that the quality was not inferior to that of other grass; this opinion, he said, was founded on botanical observation and careful chemical analysis; but he at the same time justly remarked that nothing positive could be known without experiment on cattle. In all cases, cattle eat this grass as readily as they do that of ordinary production, and appear to do as well on it. It has moreover been observed that the milk and cream of cows fed on it have both increased in quantity and improved in quality. Another very interesting and important fact has been recently developed, namely, that this action tends to improve the herbage by favoring the growth of the more valuable kinds of plants; in almost every instance it has very much increased the growth of the Dutch clover, &c. In Belgium, and many parts of the midland counties of England, it is the common practice, in order to destroy the couch-grass, &c., to manure twice on the green side with active compost; no doubt the result of this practice is to bring up the more valuable grasses, which, being delicate, require the assistance of art to insure their vigorous growth. The same results follow the action of fibrous covering, but in a more rapid manner, and certainly the quality of the herbage is improved. In many parts of fields where the action had been induced, a beautiful floor of grass now appears; while on those parts left uncovered, the grass is very inferior in appearance, having a considerable quantity of couch-grass and bent. There is no doubt therefore in practice that the quality of Gurneyized grass will be found equal if not superior to that of ordinary growth.

"It was thought by several persons during the summer, that the action of fibrous covering was occasioned by retarding evaporation, and shading the soil during the unusually dry season. This, however, is not the case; the same proportional increase of vegetation has gone on since the wet weather set in, and still continues. Mr. Gurney stated at the last meeting that he has found fibrous covering, in a late experiment during the wet weather, had brought up the eaver and clover in a barley arish, in which the seeds had failed

from the dry season." The kind of soil, and the circumctances attending the application are not stated, but we infer from the product on the ground, that it was a very thin and light, and probably a dry soil.

The observation has been frequently made in this country, that certain half-cleared pastures, where the trees and brush had been prostrated and partially burnt, leaving a heavy covering of old logs and dead branches, gave a much larger supply of feed than such as had been entirely cleared. But all the facts and attending circumstances have not been given with sufficient particularity to draw any well settled conclusions; yet from the generality of the remark by observing and careful men, there is undoubtedly some weight due to it. The same effect has been often claimed from certain stony fields, which apparently give much larger returns than others from which the stones had been removed. If the results are as have been inferred, after deducting something for what observation or science may possibly not yet have detected, we would ascribe them to two causes. 1°. The gradual decomposition of the vegetable covering and stone, and the direct food which they thus yield to the crop; and 2°. the greater and more prolonged deposit of dew, which is going forward through most of the 24 hours of every day on larger portions of the field. Does the influence of the shade and moisture promote an unusual deposite of ammonia, nitric acid, or any of the fertilizing gases? We are inclined to think nitric acid is thus formed in considerable quantities, and especially where there is an appreciable quantity of lime in the soil. Both M. Longchamp and Dr. John Davy assert, "that the presence of azotised matter is not essential for the generation of nitric acid or nitrous salts, but that the oxygen and azote of the atmosphere when condensed by capillarity, will combine in such proportions as to form nitric acid thrugh the agency of moisture and of neutralising bases, such as lime, magnesia, potash or soda."—(*Ure.*) The condition of the soil is precisely analogous to the artificial nitre beds, deducting their excess of manure and calcareous matter. These exist to some extent in every soil, and it is probable under similar circumstances they will produce an amount of nitric acid proportionate to their own quantity, which in every case will be particularly felt by the crops. We have the shade, moisture, and capillary condition similar to those of the nitric beds, for the formation and condensing of the acid, which in this instance, is washed down into the soil by every succes-

sive rain, instead of being carefully preserved as is done by the roofing of the beds. The question is one of sufficient consequence to induce further trials, under such circumstances as will be likely to afford data for estimating the precise force of the cause.

ELECTRO CULTURE. The application of electricity to growing plants is a subject which has occupied the attention of scientific men for many years, and apparently without arriving at any beneficial result. That it is capable of producing unusually rapid growth when applied to vegetation, we have too many examples to admit of any doubt. A stream of electricity from a galvanic battery, directed upon the seeds or roots of plants under a favorable condition, has sometimes produced an amount of vegetable development within a few hours, which would have required as many days or even weeks to produce, in the ordinary course of nature. An egg has been hatched in one fourth the usual period of incubation, and every dairy maid is aware of the accelerated change in the milk, from the presence of a highly electrical atmosphere. A thunder storm will sour milk in two hours that would otherwise have kept sweet two days. But after all the efforts hitherto made to secure this agent for the advancement of the farmer's operations, a careful review of all the results obtained, compels us to acknowledge that no application of electricity is yet developed, which entitles it to the consideration of practical agriculturists. Yet when we consider the power and universal presence of electricity, we must confess our confidence, that the researchers of science will hereafter detect some principles of its operation, which may be of immense value to the interests of agriculture. It is probably the principal, and perhaps the sole agent in producing all chemical changes in inert matter; nor is it at all improbable, its agency is equally paramount in the changes of vegetable and to a certain extent also, in animal life. Independent of human agency or control, it forms nitric acid in the atmosphere during thunder showers, which is brought down by the rain, and contributes greatly to the growth of vegetables. It is also efficient in the deposit of dews, and in numberless unseen ways, it silently aids in those benificent results which gladden the heart, by fulfilling the hopes of the careful and diligent husbandman. But until something is more definitely established in relation to its principles and effects, the prudent agriculturist may omit any attention to the subject of electro culture.

EXPERIMENTS AMONG FARMERS.

A great advantage would result to agriculture if every intelligent farmer would pursue some systematic course of experiments, on such a scale and variety as his circumstances would justify, and give the results if successful, to the community. It is with experiments in farming, as was said by Franklin, of a young man's owning wild lands; "it is well enough for every one to have some, *if he dont have too many.*" They should be his servants, not his masters; and if intelligently managed and kept within due bounds, they may be made greatly subservient to his own interest, and by their promulgation, eminently promotive of the general good. It is fully in accordance with another maxim of that wise head, that when it is not within our power to return a favor to our benefactor, it is our duty to confer one on the first necessitous person we meet, and thus the circle of good offices will pass round. The mutual communication of improvements of any kind in agriculture, has the effect of benefiting not only the community generally, but even the authors themselves; as they frequently elicit corrections and modifications which materially enhance the value of the discovery. These experiments should embrace the whole subject of American agriculture; soils and their amelioration; manures of every kind, alkaline, vegetable and putrescent, and their effects on different soils and crops; plants of every variety, and their adaptation to different soils, under different circumstances and with various manures; and their relations to each other, both as successors in rotation, their value for conversion into animals and other forms, and their comparative utimate profit; the production of new varieties by hybridizing and otherwise; draining both surface and covered; the improvement of implements and mechanical operations, &c. &c. They should also extend to the impartial and thorough trial of the different breeds of all domestic animals, making ultimate profit to the owner the sole test of their merits, crossing them in different ways and under such general rules as experience has determined as proper to be observed; their treatment, food, management, &c. Although much has been accomplished within the last few years, the science and practice of agriculture may yet be cosidered almost in in its infancy. There is an unbounded field still open for exploration and research, in which the efforts of persevering genius, may hereafter discover mines of immense value to the human family.

THE UTILITY OF BIRDS.

These are among the most useful of the farmer's aids, in securing his crops from insect depredation; and yet manifest as this is to every observing man, they are frequently pursued and hunted from the premises as if they were his worst enemies. The martin, the swallow and the wren, which may almost be considered among the domestics of the farm; and the sparrow, the robin, the blue bird, the wood-pecker, the bob-a-link, the yellow bird, the thrush, the oriole and nearly all the gay songsters of the field accomplish more for the destruction of noxious flies, worms and insects, (the real enemies of the farmer,) than all the nostrums ever invented.—And hence the folly of that absurd custom of scare-crows in corn-fields and orchards, to which we have before alluded; and the chickens and ducks do the farmer more benefit than injury in the garden and pleasure grounds, if kept out of the way while the young plants are coming up. A troop of young turkeys in the field, will destroy their weight in grasshoppers every three days, during their prevalence in summer. A pair of sparrows while feeding their young, will consume 3,360 catterpillars in a week. One hundred crows will devour a ton and half of grubs and insects in a season.—Even the hawk and the owl, the objects of general aversion, rid the fields and woods of innumerable squirrels, moles and field mice, which are frequently great depredators upon the crops, (after having exhausted the stores of worms and insects which they first invariably devour,) and the smaller species when pressed by hunger, will even resort to grubs, beetles and grasshoppers, in the absence of larger game. That loathsome monster the bat, in its hobgoblin, murky flight, will destroy its bulk of flies in a single night. Slight injury may occasionally be done to the grain and fruit by the smaller birds, and when thus intrusive, some temporary precaution will suffice to prevent much loss. But whatever it may be, the balance of benefit to the farmer from their presence, is generally in their favor, and instead of driving them from his grounds, he should encourage their social, chatty visits by kind and gentle treatment, and by providing trees and pleasant shrubbery for their accommodation.

Toads, Frogs, &c.—Shakespeare has said "*the toad*, ugly and venomous, wears yet a precious jewel in his head." Deducting the *venom* we shall find the poet right; for we can no more attempt the defence of his beauty, than that of the

muck heap; and we can well excuse his unprepossessing exterior, for the sake of the jewel which he wears in his tongue. This, like that of the chamelion, of which he is a cousin-german, he darts out with lightning rapidity, and clasps his worms or insect prey within its glutinous folds, which is with equal rapidity transformed to his capacious maw. Apparently dull, squat, and of the soil's hue, whatever that may be, he sits silent, meditative, yet watchful in the thick shade of some overgrown cabbage; and then as the careless insects buzz by, or the grub or beetle crawl along unheedful of danger, he loads his aldermanic carcass with the savory repast. Sixteen fresh beetles, a pile equal to his fasting bulk, have been found in the stomach of a single toad. *The Frog*, traipsing over the dewy fields, procures his summer subsistence in the same way as his seeming congener the toad, and with equal benefit to the farmer. *The striped snake* is a harmless object about the farm premises, and like the toad, he is also a great gormandiser of worms and insects. The sole drawback to his merits, is occasionally feasting on the toad and frog.—*The black snake* is sometimes destructive to young poultry, and he is a fierce and formidable foe to all whom his indomitable courage induces him to attack. He charms the old birds and robs their nests both of eggs and young; but his consumption of superfluous squirrels and field mice, perhaps fully atones for his own delinquencies.

FENCES.

In many countries which have been long under cultivation, with a dense population and little timber, as in China, and other parts of Asia, Italy, France, Belgium, Holland and other parts of Europe, fences are seldom seen. In certain sections of the older settled portions of the New England states also a similar arrangement prevails. This is especially the case over the wide intervals or bottom lands which skirt the banks of the Connecticut river, where periodical inundations would annually sweep them away.—Wherever this systen is adopted, cultivation proceeds without obstruction, and a great saving is made not only in their original cost, but in the interest, repairs and renewal; all the land is available for crops; no weeds or bushes are permitted to send their annoying roots or scatter their seeds over the ground; no safe harbors are made for mice, rats or other vermin; the trouble and expense of keeping up bars or gates are avoided; and a free course is allowed by the con-

ceded roads or bye paths, for the removal of the crops, and carrying on manures, and the necessary passing to and fro in their cultivation. These are important advantages, which it would be well for every community to consider, and secure to the full extent of their circumstances. The inconveniences of this arrangement are trifling. When cattle or sheep are pastured in Europe, where fences are wanting, they are placed under the guidance of a shepherd, who with the aid of a well trained dog, will keep a large herd of animals, in perfect subjection within the prescribed limits. In the unfenced part of the Connecticut valley, (where extensive legislative powers reside in the separate towns, which enables each to adopt such regulations as best comport with their own interests,) no animals are permitted to go on to the fields till autumn, and the crops are required to be removed at a designated time, when each occupant is at liberty to turn on to the common premises, a number of cattle proportionate to his standing forage, which is accurately ascertained by a supervisory board. A certain number of fences are necessary for such fields as are continued in pasture through the season, but unfortunately, custom in this country has increased them beyond all necessity or reason. It rests with the farmers to abate such as they deem consistent with their interests.

The kind of fences should vary according to the controlling circumstances of the farm. In those situations where stone abounds, and especially if it is a nuisance, heavy stone fences, broad, and high are undoubtedly the most proper. Where these are not abundant, an economical fence may be constructed, by a substantial foundation of stone reaching two or two and a half feet above ground, in which posts are placed at proper distances, with two or three bar holes above the wall, in which an equal number of rails are inserted. Post and rail and post and board fences are common where there is a deficiency of timber. The posts should be placed from two and a half to three feet below the surface in the centre of a large hole and surrounded by fine stone, which should be well pounded down by a heavy-iron shod rammer as they are filled in. The post will not stand as firmly at first as if surrounded by dirt, but it will last much longer. The lower end should be pointed which prevents its heaving with the frost. If the position of the post while in the tree be reversed, or the upper end of the split section of the trunk which is used for a post, be placed in the earth, it will be more durable. Charring or partially burning the part of the post

which is buried, will add to its duration. So also will imbedding it in ashes, lime, charcoal, or clay; or it may be bored at the surface with a large auger, diagonally downwards and nearly through, filled with salt, and closely plugged. The best timber for posts in the order of its durability, is red cedar, yellow locust, white oak and chestnut. We recently saw red cedar posts used for a porch which we were assured had been standing exposed to the weather previous to the Revolution, and they were still perfectly sound. The avidity with which silicious sands and gravel act upon wood, renders a post fence expensive for such soils.

There are large portions of our country where timber abounds, especially in the uncleared parts of it, where the zig-zag, worm or Virginia fence is by far the most economical. The timber is an incumbrance and therefore costs nothing, and the rails can be cut and split to 10 or 12 feet long, for 50 to 75 cents per 100; and the hauling and placing is still less. With good rails, well laid up from the ground on stones or durable blocks, and properly crossed at the ends and locked at the top, they are firm and durable. Staking the corners by projecting rails gives an unsightly appearance at all times, and is particularly objectionable for plowing, as it considerably increases the waste ground. The same object is obtained by locking the fence when completed, with a long rail on each side, one end resting on the ground and the other laid into the angle in a line with the fence. More symmetry and neatnes is secured, and a trifling amount of timber saved, by putting two small upright stakes, one on each side of the angle, and securing them by a white oak plank six inches wide by eighteen inches long, with two holes of three inches diameter bored eight inches apart, and slipped over the posts after most of the rails have been laid. The additional ones which may be laid over it, keep the yokes or caps in their place and the whole is thus firmly bound together. In addition to the timber designated for posts, rails may be made from any kind of oak, black walnut, black and white ash, elm, and hickory.

Turf and clay fences have been tried in this country without success. Our frosts and rains are so severe as to break and crumble them down continually. Cattle tread upon and gore them; and to swine and sheep they scarcely offer any resistance. *Wire fences* have been suggested, and if galvanized wire which is not liable to rust, could be procured at a reasonable cost, it would combine gracefulness and utility

in a high degree. *The hurdle* or light moveable fence is variously formed of cordage, wire or wicker work, in short panels, and firmly set into the ground by sharpened stakes at the end of each panel, and these are fastened together. This is a convenient appendage to farms where heavy green crops of clover, lucern, peas, turneps, &c. are required to be fed off in successive lots, by sheep, swine or cattle. *The sunken fence* or wall is by far the most agreeable to good taste, and it is perfectly efficient. It consists of a vertical excavation on one side, about five feet in depth, against which a wall is built to the surface of the ground. The opposite side is inclined at such an angle as will preserve the sod without sliding from the effects of frost or rain, and is then turfed over. A farm thus divided, presents no obstruction to the view, while it is every where properly walled in, besides affording good ditches for the drainage of water. These sunken fences are sometimes raised a couple of feet above the ground, which increases the protection, at a less cost than deepening and widening the ditch. Good fences, at all times kept in perfect repair, are the cheapest. Most of the unruly animals are taught their habits by their owners. Fences that are half down or which will fall by the rubbing of cattle, will soon teach them to jump and throw down such as they are unable to overleap. For the same reason, gates are better than bars. When the last are used, they should be let down so near the ground that every animal can step over conveniently; nor should they be hurried over so fast as to induce any animal to jump. In driving a flock of sheep through them, the lower bars ought to be taken entirely out, or they be allowed to go over the bars in single file. Animals will seldom become jumpers except through their owners fault, or from some bad example set them by unruly associates; and unless the fences be perfectly secure, these ought to be stalled till they can be disposed of. The farmer will find that no animal will repay him the trouble and cost of expensive fences and ruined crops.

Hedges have from time immemorial, been used in Great Britain and some parts of the European continent, but are now growing unpopular with utilitarian agriculturists. They occupy a great deal of ground, and harbor much vermin. A few only have been introduced in this country, and they will probably never become favorites among us. For those

disposed to try them as a matter of taste or fancy, we would enumerate the *English hawthorn*, beautiful and hardy; the *holly*, with an evergreen leaf, handsomely variegated with yellow spots, and armed at the edges with short stiff thorns; the *gorse* or *furze*, a prickly shrub growing to the height of five feet or more and bearing a yellow blossom. These are much cultivated in Europe as defences against the inroads of animals; while numerous other less formidable shrubs, like *the willow* and *privet* are grown for protection against winds, and when sufficiently large, they serve for cattle enclosures. In America the *buckthorn* was first introduced by Mr. Derby of Massachusetts, and by him was considerably disseminated through the United States, and has proved a hardy thrifty plant, entirely suited to the purpose. The *Osage orange* grows spontaneously in the southern states and is said to endure a northern climate. Its numerous thick tough branches and thorns, render it an effectual protection to fields. We have fenced with the *native thorn* of Western New-York, with entire success. The *Michigan rose* and the *sweet briar*, both hardy and of luxuriant growth, and some other species of the native rose, have been tried and proved efficient. The *crab apple* and *wild plum*, with their thick tough branches and formidable thorns, (and especially the latter,) with proper training will be found a perfect stoppage against animals of all kinds. The *yellow locust* and *acacia* have been sometimes used; and the *wild laurel*, an evergreen of great beauty at all times, and especially so with its magnificent blossoms, would form a beautiful hedge wherever the soil will give it luxuriant growth. There are a variety of other trees and shrubs of native growth among us, which may be employed for hedges, but it is unnecessary to specify them, as each can best select for himself what his judgment sanctions from the known character of the plant, as best suited to his own peculiar soil and circumstances.

SHADE TREES,

In such situations and numbers as may be required around the farm premises, are both ornamental and profitable. They have too a social and moral influence far beyond the mere gratification of the eye or the consideration of dollars and cents. In their freshness and simplicity, they impress the young mind with sentiments of purity and loveliness as enduring as life. From the cradle of infancy, consciousness

first dawns upon the beauty of nature beneath their grateful shade; the more boisterous sports of childhood seek their keenest enjoyment amid their expanded foliage; and they become the favorite trysting place when the feelings assume a graver hue, and the sentiments of approaching manhood usurp the place of unthinking frolic. Their memory in after life greets the lonely wanderer amid his trials and vicissitudes, inciting him to breast adversity till again welcomed to their smiling presence. Their thousand associations repress the unhallowed aspirations of ambition and vice; and when the last sun of decrepid age is sinking to its rest, these venerable monitors solace the expiring soul with the assurance, that a returning spring shall renew its existence beyond the winter of the tomb.

Trees ought not to stand too near the buildings, but occupy such a position as to give beauty and finish to the landsape. In addition to danger from lightning, blowing down, or the breaking off of heavy branches, there is an excessive dampness from their proximity which produces rapid decay in such as are of wood, and which frequently affects the health of the inmates. Low shrubbery that does not cluster too thickly and immediately around the house, is not objectionable. Trees are ornamental to the streets and highways, but should be at such a distance from the fences, as will prevent injury to the crops and afford a grateful shade to the wayfarer. In certain sections of the middle and southern states, where the soil is parched from the long sultry summers, it has been found that shade trees rather increased than diminished the forage of the pastures, but through most of the middle and northern states, they are decidedly disadvantageous, as the feed is found to be sweeter and more abundant beyond their reach. For this reason, such trees as are preserved exclusively for timber should be kept together in the wood-lots, and even many that are designed for necessary shade or ornament may be grouped in tasteful copses, with greater economy of ground and manifest improvement to the landscape.

In the selection of trees, regard should be had not only to the beauty of the tree and its fitness for shade, but to its ultimate value as timber and fuel. The *elm* when standing isolated is one of our most graceful and imposing trees. It grows to an immense size with gracefully projecting limbs and long pendant branches. It is liable to few diseases, and

the fuel and timber are good for most purposes. Every one who has seen the patriarchal elms which grace the beautiful villages of the Connecticut valley and other old towns of New England, must wish to see them universally disseminated. The *rock or sugar maple* is a beautiful tree, having a straight trunk and regular upward-branching limbs, forming a top of great symmetry and elegance. Besides the ornament and thick shade it affords, it gives an annual return in its sap which is used for making into sugar and syrup; the fuel is equal to any of our native trees; the timber is valuable, yielding the beautiful glossy *bird's-eye maple* so much esteemed for furniture. The *black walnut* is a stately, graceful tree, of great value for wood and durable timber, and besides its extensive use for plain substantial furniture, the knots and crotches make the rich dark veneering, which rivals the mahogany or rose-wood in brilliancy and lasting beauty. In a fertile soil it likewise bears a highly flavored nut. The *white ash* has a more slender and a stiffer top than either of the preceding, yet is light and graceful. The fuel is good and the timber unequalled in value for the carriage maker. The *weeping willow* is a tree of variegated foliage, and long flexile twigs, sometimes trailing the ground for yards in length. Its soft silvery leaves are among the earliest of spring, and the last to maintain their verdure in autumn. Its timber is worthless and the wood of little value. *The black oak* on soil adapted to it, is a tree of commanding beauty and stalwart growth. The foliage appears late, but is unsurpassed for depth and richness of color and highly polished surface, and it retains its summer green, long after the early frosts have mottled the ash and streaked the maple with their rain-bow hues. When grown on dry and open land, both fuel and timber are valuable. The *locust* is a beautiful tree, of rapid growth, flowering profusely and with layers or massive flakes of innumerable leaflets of the deepest verdure. The wood is unrivalled for durability as ship timber except by the *live-oak*; and for posts or exposure to the weather, it is exceeded only by the savin or red cedar. It has of late years been subject to severe attack and great injury from the borer, a worm against whose ravages hitherto there has been no successful remedy. The *button-wood*, *sycamore*, *plane-tree*, *water-beach* or *cotton-tree*, by all of which names it is known in different parts of this country, is of gigantic dimensions when occupying a rich and moist

alluvial soil. One found on the banks of the Ohio measured 47 feet in circumference, at a height of four feet from the ground. Its lofty mottled trunk, its huge irregular limbs, and its numerous pendant balls, in which are compressed myriads of seeds with their plumy tufts that are wafted to immense distances for propagation, have rendered it occasionally a favorite. They are often seen on the banks of our, rivers where the branches interlock, and sometimes they completely span streams of considerable size. The wood is cross-grained and intractable for working, and the timber is of little use. The great variety of American shade-trees, both deciduous and evergreen, far surpasses that within the same area on any portion of the eastern continent, but it would be transcending our limits farther to particularize them.

WOOD LANDS.

There are few farms in the United States, where it is not convenient and profitable to have a wood lot attached. They supply the owner with his fuel, which he can prepare at leisure times, they furnish him with timber for buildings, rails, posts and for the occasional demands for implements; they require little attention, and if well managed, will yield a good supply of forage for cattle and sheep. The trees should be kept in a vigorous, growing condition, as the profits, are as much enhanced from this cause as any of the cultivated crops. Few of our American fields require planting with forest trees. The soil is everywhere adapted to their growth, and being full of seeds and roots when not too long under cultivation, it needs but to be left unoccupied for a while, and they will everywhere spring up spontaneously. Even the oak openings of the west, with here and there a scattered tree, and such of the prairies as border upon wood lands, when rescued from the destructive effects of the annual fires, will rapidly shoot up into vigorous forests. We have repeatedly seen instances of the re-covering of oak barrens and prairies with young forests, which was undoubtedly their condition before the Indians subjected them to conflagration; and they have indeed, always maintained their foothold against these desolating fires, wherever there was moisture enough in the soil to arrest their progress. In almost every instance, if the germs of forest vegetation have not been extinguished in the soil, the wood lot may be safely left to self propagation, as it will be certain to produce those trees which

are best suited to the present state of the soil. Slightly thinning the young wood may in some cases be desirable, and especially by the removal of such worthless shrubbery as never attains a size or character to render it of any value. Such are the alders, the blue beach, swamp-willow, &c., and where there is a redundance of the better varieties of equal vigor, those may be removed that will be worth the least when matured. In most of our woodlands however, nature is left to assert her own unaided preferences, growing what and how she pleases, and it must be confessed she is seldom at variance with the owner's interest. Serious and permanent injury has often followed close thinning. In cutting over woodlands, it is generally best to remove all the large trees on the premises at the same time. This admits a fresh growth on equal footing, and allows that variety to get the ascendancy to which the soil is best suited. In the older settled states, where land and its productions are comparatively high, many adopt the plan of clearing off every thing, even burning the old logs and brush, and then sow one or more crops of wheat or rye, for which the land is in admirable condition, from the long accumulation of vegetable matter and the heavy dressing of ashes thus received. They then allow the forest to resume its original claims, which it is not slow to do, from the abundance of seeds and roots in the ground. But unless the crop be valuable the utility of this practice is doubtful, as by the destruction of all the young stuff which may be left, there is a certain delay of some years in the after growth of the wood; and the gradual decay of the old trunks and brush may minister fully as much to its growth as the ash which their combustion leaves; and the fertility of the soil is diminished just in proportion to the amount of vegetable matter, which may have been abstracted by the grain crops taken off. The proper time for cutting over the wood must depend on its character, the soil, and the uses to which it is to be applied. For saw logs or frame timber, it should have a thrifty growth of 40 or 50 years; but in the mean time much scattering fuel may be taken from it, and occassionally such mature timber trees as can be removed without injury to the remainder. For fuel alone, a much earlier cutting has been found most profitable. The Salisbury Iron Company in Connecticut, has several thousand acres of land, which were purchased and have been reserved exclusively for supplying their own charcoal. The intelligent manager informed us when recently there, that from an experience of 60 years, they had

ascertained the most profitable period for cutting, was once in about 16 years, when every thing was removed of an available size, and the wood was left entirely to itself for another growth. It has been found that this yielded an annual interest on \$16 to \$20 an acre, which for a rough and rather indifferent soil, remote from a wood or timber market, will pay fully as much as the nett profits on cultivated land in the neighborhood.

When young, the wood should be kept entirely free from sheep and cattle, as they feed upon the fresh shoots with nearly the same avidity as they do upon grass or clover, and when it is desirable to thicken the standing trees by an additional growth, cattle should be kept from the range till such time as the new sprouts or seedling may have attained a height beyond their reach. Where it is desirable to bring into woodland such fields as have not forest roots or seeds already deposited in a condition for germination, the fields should be sown or planted with all the various nuts or seeds adapted to the soil, and which it is desirable to cultivate. Transplanting trees for a forest in this country, cannot at present be made to pay from its large expense, and if the trees will not grow naturally or by sowing, the land should be continued in pastures or cultivation. There are some lands so unfitted for tillage by their roughness or texture, as to be much more profitable as woodland. It is better to retain such in forest, and make from them whatever they are capable of yielding, than by clearing and bringing them into use, to add them to what are perhaps already superfluous tillage fields, and become a drain on labor and manures which they illy repay.

In clearing lands, when it is desirable to reserve sufficient trees for a park or shade, a selection should be made of such as are young and healthy which have grown in the most open places, with a short stem and thick top. It will tend to insure their continued and vigorous growth, if the top and leading branches be shortened. A large tree will seldom thrive when subjected to the new condition in which it is placed, after the removal of the shade and moisture by which it has been surrounded. They will generally remain stationary or soon decay; and the slight foothold they have upon the earth by their roots, which was sufficient for their protected situation while surrounded by other trees, exposes them to destruction from violent gales; and they seldom have that beauty of top and symmetry of appearance which should entitle them to be retain-

ed singly. If partialities are to be indulged for any, they should be surrounded by a copse of younger trees by which they will be in a measure protected. Young stocks should be left in numbers greater than are required, as many of them will die, and from the remainder selections can be made of such as will best answer the purposes designed.

THE PROPER TIME FOR CUTTING TIMBER.

Nine-tenths of the community think winter the time for this purpose, but the reason assigned "that the sap is then in the roots" shows its futility, as it is evident to the most superficial observer that there is nearly the same quantity of sap in the tree at all seasons. It is less active in winter, and like all other moisture, is congealed during the coldest weather; yet when not absolutely frozen, circulation is never entirely stopped in the living tree. Reason or philosophy would seem to indicate that the period of the maturity of the leaf, or from the last of June to the first of November, is the season for cutting timber in its perfection. Certain it is, that we have numerous examples of timber cut within this period, which has exhibited a durability twice or three times as great as that cut in winter, when placed under precisely the same circumstances. After it is felled, it should at once be peeled, drawn from the woods and elevated from the ground to facilitate drying; and if it is intended to be used under cover, the sooner it is put there the better. Wood designed for fuel, will spend much better when cut as above mentioned and imediately housed, but as this is generally inconvenient from the labor of the farm being then required for the harvesting of the crops, it may be more economical to cut it whenever there is most leisure.

Preservation of timber.—Various preparations of late years have been tried for the more effectual preservation of timber, which have proved quite successful, but the expense precludes their adoption for general purposes. These are Kyanizing, or the use of carbureted azote, (the base of prussic acid;) the use of corrosive sublimate, a bi-chloride of mercury; pyrolignite of iron, formed from iron dissolved in pyrolignous acid, (which is produced from the distillation of of wood, or from the condensed vapor that escapes from wood fuel while burning, and which may be obtained in large quantities from a coal pit where charcoal is made;) and a solution of common salt. These will be absorbed by the sap pores and universally disseminated through the body of the

tree, by sawing or cutting the trunk partially off while erect, and applying the solution to its base; or it may be cut down, leaving a part of the leafy branches above the point of saturation, and apply the solution to the butt end. Beautiful tints are given to timber which is used for cabinet work, by saturating it with various coloring matters. Although the expense of these preparations may prevent their use for large, cheap structures, yet for all the lighter instruments, such as farmer's tools, plows, &c., where the cost of the wood is inconsiderable in comparison with that of making, it would be economy to use such timber only as will give the longest duration, though its first price may be ten-fold that of the more perishable material.

FARMING TOOLS.

These should form an important item of the farmer's attention, as upon their proper construction depends much of the economy and success with which he can perform his operations. There have been great and important improvements within the past few years, in most of the implements, which have diminished the expense while they have greatly improved the mechanical operations of agriculture. We have studiously avoided a reference to any of these, as there are many competitors for similar and nearly equal improvement, and in this career of sharp and commendable rivalry, what is the best to-day, may be supplanted by something better to-morrow. These implements may now be found at the agricultural ware-houses, of almost every desirable variety. Of these, the best only should be procured; such as are the most perfect in their principles and of the most durable materials. The wood work should be well guarded with paint, if to be exposed to the weather, and the iron or steel with paint, or a coating of hot tar, unless kept brightened by use. When required for cutting, they should always be sharp, even to the hoe, the spade and the share and coulter of the plow. When not in use, they ought to be in a dry place. Plows, harrows, carts and sleds, should all be thus protected, and by their longer durability they will amply repay the expense of shed room. They ought also to be kept in the best repair, which may be done at leisure times so as to be ready for use. [Some additional remarks on this subject will be found under the head of "plows."]

THE AGRICULTURAL EDUCATION OF THE FARMER.

Though last mentioned, this is of the first importance to the farmer's success. It should commence with the thorough groundwork attainments every where to be acquired in our primary schools, and should embrace the elementary knowledge of mechanics, botany, chemistry and geology, nor can it be complete without some acquaintance with anatomy and physiology. The learner ought then to have a complete, practical understanding of the manual operations of the farm, the best manner of planting, cultivating and securing crops; he should be familiar with the proper management, feeding and breeding of animals; the treatment of soils, the application of manures, and all the various matters connected with agriculture. This will be but the commencement of his education, and it should be steadily pursued through the remainder of his life. He must learn from his own experience, which is the most certain and complete knowledge he can obtain, as he thus ascertains all the circumstances which have led to certain results; and he should also learn from the experience of his neighbors, and from his personal observation on every subject that comes within his notice. He will be particularly assisted by the cheap, agricultural journals of the present day, which embrace the latest experience of some of our best farmers throughout remote sections of country, on almost every subject pertaining to his occupation. To these should be added, the selection of standard, reliable works on the various topics of farming, and of the latest authority which can be procured for direction and reference. It is much to be desired, that *agricultural schools and colleges* could be added to the list of *aids to farming*, where experienced and gifted minds should be placed, surrounded by the means for conveying instruction in the fullest, yet most simple and effective manner, and with every requisite for practical illustration. We cannot permit ourselves to doubt, that this neglected field will soon be efficiently occupied, and thus supply the only link remaining in the thorough education of the farmer.

CHAPTER XIII.

FARM BUILDINGS.

Great neglect is manifest in this country, in the erection of suitable farm buildings. The deficiency extends not only to their number, which is often inadequate to the wants of the farm, but more frequently to their location, arrangement and manner of construction. The annual losses which occur in consequence of this neglect, would in a few years, furnish every farm in the Union with barns and out-houses entirely sufficient for the necessities of each. We will give briefly in detail, the leading considerations which should govern the farmer in their construction.

THE FARM HOUSE.

If this is required for the occupation of the owner, it may be of any form and size his means and taste dictate. If for a tenant, and to be employed solely with a reference to its value to the farm, it should be neat, comfortable and of convenient size. It should especially contain a cool, airy and spacious dairy room, unless the owner should prefer one independant of the house, over a clear spring or cool rivulet, where, partially protected from the sun by a sheltering bank, half buried in the earth and made, as it should be if possible, of stone, the cool atmosphere within will afford the best safeguard against flies and other insects, and preserve the butter and cheese in the finest condition. Stone or brick are the best materials for dwellings, as they are cooler in summer and warmer in winter, and if comfort be the object of the farmer's toil, there is certainly no place where it should be sooner consulted than in his own domicil. A naked, scorching exposure, equally with a bleak and dreary one is to be avoided. The design of a house is protection to its inmates, and if there be no adequate shelter from the elements, it fails in its purpose. It should be tastefully built, as this need not materially increase the expense, while it adds a

pleasant feature to the farm. It ought to occupy a position easily accessible to the other buldings and the fields, and yet be within convenient distance of the highway. It is desirable to have it so far removed as to admit of a light screen of trees, and nature will thus add an ornament and protection in the surrounding foliage, which no skill of the architect can equal.

The Cellar.—This is an essential appendage to a house, particularly where roots are to be stored. Many appropriate a part of it to the dairy, and if thus employed it should be high, clean and well ventilated. The proper preservation of what is contained in it, and the health of the inmates, demand a suitable dryness and free circulation of air. The cellar is frequently placed on the side of a hill, which renders it more accessible from without. This is in no respect objectionable, if the walls are made sufficiently tight to exclude the frosts. When on level ground, they should be sunk only three or four feet below the natural surface, and the walls raised enough above to give all the room wanted; and the excavated earth can be banked around the house, thus rendering it more elevated and pleasant. It also provides for the admission of light and air through small windows, which are placed above ground. A wire gauze to exclude flies, ought to occupy the place of the glass in warm weather, and if liable to frosts, there should be double sashes in winter. Ventilation is important in all seasons, and it may be secured by as large an aperture as possible connected with the chimney, and the windows may be thrown open in pleasant weather during the warmer part of the day. The cellar should be connected with the kitchen or sheds above, by safe, well lighted stairs. And lastly, the entire building should be rat-proof. This is more easily accomplished than is generally imagined. When erecting a building, a carpenter or mason, for less than the additional expense of a year's support for a troop of rats, can for ever exclude them from it, by the exercise of a little ingenuity. A brick floor in a cellar is easily broken up by these insidious and and ever-busy vermin, and a plank or wooden floor is objectionable, from its speedy decay. The most effective and permanent barrier to their inroads, is afforded by a stone pavement laid with large pieces in cement, closely fitted to each other and to the side walls. This is also secured by placing a bed of small stones and pebbles on the ground and *grouting*, or pouring over it a mortar made of lime and sand so thin as to run freely between the stones. When dry

a thin coating of water-lime cement is added, which is smoothed over with the trowel. This can be so laid as to admit of ready and perfect drainage, by a depression in the centre or sides, which answers for gutters.

THE BARN is the most important appendage of the farm, and its size and form must depend on the particular wants of the owner. It is sometimes essential to have more than one on the premises, but in either case they should be within convenient distance of the house. They should be large enough to hold all the fodder and animals on the farm. Not a hoof about the premises should be required to brave our northern winters, unsheltered by a tight roof and a dry bed. They will thrive so much faster and consume so much less food when thus protected, that the owner will be ten-fold remunerated. Disease is thus often prevented, and if it occurs, is more easily removed. The saving in fodder by placing it at once under cover when cured, is another great item of consideration. Besides the expense of stacking and fencing, the waste of the tops and outside fodder in small stacks, is frequently one fourth of the whole, and if carelessly done, it will be much greater. There is the further expense of again moving it to the barn, or foddering it in the field, which greatly increases the waste. It is a convenient mode to place a barn on a side hill inclining to the south-east, whenever the position of the ground admits of it. There are several advantages connected with this plan. Room is obtained by excavation and underpinning, more cheaply than in building above. An extensive range of stabling may be made below, which will be warmer than what is afforded by a wooden building, and the mangers are easily supplied with the fodder which is stored above. Extensive cellar room can be had next to the bank, in which all the roots required for the cattle can be safely stored in front of their mangers, and where they are easily deposited from carts through windows arranged on the upper side, or scuttles in the barn-floor above. More room is afforded for hay in consequence of placing some of the stables below, and in this way, a large part of the labor of pitching it on to elevated scaffolds is avoided. The barn and sheds ought to be well raised on good underpinnings, to prevent the rotting of sills, and to allow the free escape of moisture, as low, damp premises are injurious to the health of animals.

Every consideration ought to be given to the saving of manure. The stables should have drains that will carry off the

liquid evacuations to a muck-heap or reservoir, and whatever manure is thrown out, should be carefully protected. The manure contains the future crops of the farmer, and unless he is willing to forego the latter, he should carefully husband the former. A low roof projecting several feet over the manure which is thrown from the stables, will do much to prevent waste from sun and rains. The mangers ought to be so constructed as to economize the fodder. Box-feeding for cattle we prefer, as in addition to hay, roots and meal may be fed in them without loss; and with over-ripe hay, a grat deal of seed may in this way be saved, which will diminish the quantity necessary to be purchased for sowing. The fine leaves and small fragments of hay are also kept from waste, which in racks are generally lost by falling on the floor. We object to racks, unless provided with a shallow box underneath, and to foddering in the open yards. There is a loss in dragging the forage to them, and too often this is done near a herd of hungry cattle, which gore each other and are scarcely to be kept at bay by the use of the stoutest goad. There is also a waste of the hay which falls while the cattle are feeding, and which is largely increased in muddy yards; added to which the animals are exposed to whatever bad weather there may be while eating, which is at all times to be deprecated.

Sheds.—Feeding in sheds is far better, and in many instances may take the place of the stall or stable. They are frequently and very properly arranged on two sides of the cattle yard, the barn forming one end, and the other opening to the south, unless this is exposed to the prevailing winds. This arrangement forms a good protection for the cattle, and the sheds being connected with the barn is of importance in economizing the labor in foddering. The racks or boxes are placed on the boarded side of the shed, which forms the outer side of the yard, and they are filled from the floor overhead. If the space above is not sufficient to contain the necessary quantity of fodder, it should be taken from the mows or scaffolds of the barn, and carried or dragged over the floor to the place wanted. The floors ought to be perfectly tight to avoid waste, and the sifting of the particles of hay or seed on the cattle or sheep. Unless the ground under the shed be quite dry, it is better to plank it, and it will then admit of cleaning with the same facility as the stables. A portion of the shed may be partitioned off for close or open stalls, for colts, calves or infirm cattle, and cows or ewes that are heavy with young.

A little attention of this kind, will frequently save the life of an animal, or add much to their comfort and the general economy of farm management. The surplus straw, corn-stalks and the like, can be used for bedding, though it is generally preferable to have them cut and fed to the cattle.

WATER FOR THE CATTLE YARD

Is an important item, and if the expense of driving the animals to a remote watering place, the waste of manure thereby occasioned, the straying of cattle and sometimes loss of limbs or other injury resulting from their being forced to go down icy slopes or through excessive mud, to slake their thirst—if all these considerations are taken into account, they will be found annually to go far towards the expense of supplying water in the yard, where it would at all times be accessible. All animals require water in winter, except such as have a full supply of roots; and though they sometimes omit going to distant and inconvenient places where it is to be had, they may nevertheless, suffer materially for the want of it. When it is not possible to bring a stream of running water into the yard, or good water is not easily reached by digging, an effectual way of procuring a supply through most of the, year is by the construction of

Cisterns. Where there is a compact clay, no further preparation is necessary for stock purposes, than to excavate to a sufficient size; and to keep up the banks on every side, place two frames of single joist around it near the top and bottom, between which and the banks, heavy boards or plank may be set in an upright position, reaching from top to bottom. The earth keeps them in place on one side, and the joist prevents their falling. They require to be only tight enough to prevent the clay from washing in. No appreciable quantity of water will escape from the sides or bottom. We have used one for years, without repairs or any material wasting of water. This should be made near the buildings; and the rains carefully conducted by the eaves-troughs and pipes from an extensive range, will afford an ample supply. For household purposes, one should be made with more care and expense, and so constructed as to afford pure filtered water at all times. These may be formed in various ways, and of different materials, stone, brick, or even wood; though the two former are preferable. They should be permanently divided into two apartments, one to receive the water and another for a resorvoir to contain such as is ready

for use. Alternate layers of gravel, sand, and charcoal at the bottom of the first, and sand and gravel in the last, are sufficient; the water being allowed to pass through the several layers mentioned, will be rendered perfectly free from all impurities. Some who are particularly choice in preparing water, make use of filtering stones, but this is not essential. Occasional cleaning may be necessary, and the substitution of new filtering materials will at all times keep them sweet.

THE CARRIAGE HOUSE, STABLE AND GRANARY.

The carriage house and horse stable sometimes occupy a distinct building, which is a good precaution against fire, and where this is the case, it is frequently convenient to have the upper loft for a granary. The propriety of having this proof against rats is obvious. Yet it should be capable of thorough ventilation when the grain is damp or exposed to injury from want of air. Entire cleanliness of the premises, is the best remedy against weevil and other noxious insects.

The *corn crib.*—If there be more Indian corn on the premises than can be thinly spread over an elevated dry floor, the corn crib for storing it should occupy an isolated position. This should be made of upright lattice work, with a far projecting roof, and sides inclining downwards to each other, so as to avoid the admission of rain. The corn in the cob is stored in open bins on either side, leaving ample room in the centre for threshing or the use of the corn sheller. Close bins may occupy the ends for the reception of the shelled grain. All approach from rats and other vermin may be avoided by placing the building on posts, with projecting stones or sheet iron on the top, and so high that they cannot reach it by jumping.

A TOOL HOUSE AND WORK SHOP ought always to have a place about the premises. In this building, all the minor tools may be arranged on shelves, or in appropriate niches, where they can at once be found, and will not be exposed to theft. Here too the various farming tools may be repaired, which can be anticipated and done in those leisure intervals which often occur. *Ample shed room for every vehicle and implement about the farm,* should not be wanting. Their preservation will amply repay the cost of such slight structures as may be required to house them. A wagon, plow, or any wooden implement, will wear out sooner by exposure

to all weathers without use, than by careful usage with proper protection.

A HORSE POWER either stationary or moveable, can be made to contribute greatly to the economy of farming operations, where there is much grain to thresh, or straw, hay or corn stalks to cut. With the aid of this, some of the portable mills may crush and grind much of the grain required for feeding. Even the water may be pumped by it into large troughs for the use of cattle, and all the fuel sawed, thereby saving more expensive in labor.

A STEAMING APPARATUS.

Where there are many swine to fatten, or grain is to be fed, this is at all times an economical appendage to the farm. It has been shown from several experiments, that cattle and sheep will generally thrive as well on raw as on cooked roots; but horses do better on the latter, and swine will not fatten on any other. For all animals excepting store sheep, and perhaps even they may be excepted, grain or meal is better when cooked. Food must be broken up before the various animal organs can appropriate it to nutrition; and whatever is done towards effecting this object before it enters the stomach, diminishes the necessity for the expenditure of vital force in accomplishing it, and thereby enables the animal to thrive more rapidly and do more labor, on a given amount. For this reason we apprehend, there may have been some errors undetected in the experiments in feeding sheep and cattle with raw and cooked roots, which results in placing them apparently on a par as to their value for this purpose. The crushing or grinding of the grain insures more perfect mastication, and is performed by machinery at much less expense, than by the animals consuming it. The steaming or boiling is the final step towards its easy and profitable assimilation in the animal economy. With a capacious steaming-box for the reception of the food, the roots and meal, and even cut hay, straw and stalks may be thrown in together, and all will thus be most effectually prepared for nourishment. There is another advantage derivable from this practice. The food might at all times be given at the temperature of the animal system, about 98° of Farenheit, and the animal heat expended in warming the cold and sometimes frozen food, would be avoided.

The steaming apparatus is variously constructed. We have used one consisting of a circular boiler five and a half

feet long by twenty inches diameter, made of boiler iron and laid lengthwise on a brick arch. The fire is placed underneath and passes through the whole length and over one end, then returns in contact with the boiler through side flues or pockets, where it entered the chimney. This gives an exposure to the flame and heated air of about 10 feet. The upper part is coated with brick and mortar to retain the heat, and three small test cocks are applied at the bottom, middle and upper edge of the exposed end, to show the quantity of water in it ; and two large stop cocks on the upper side for receiving the water and delivering the steam, completes the boiler. The steaming-box is oblong, seven or eight feet in length, by about four feet in depth and width, capable of holding 60 or 70 bushels, made of plank grooved together, and clamped and keyed with four setts of oak joist. We also used a large circular tub, strongly bound by wagon tire and keyed, and holding about 25 bushels. The covering of both must be fastened securely ; but a safety valve is allowed for the escape of steam, which is simply a one and a half inch auger hole. Into these, the steam is conveyed from the boiler, by a copper tube, attached to the steam delivery cock for a short distance, when it is continued into the bottom of the box and tub by a lead pipe, on account of its flexibility, and to avoid injury to the food from the corrosion of the copper. It is necessary to have the end of the pipe in the steaming-box, properly guarded by a metal strainer, to prevent its clogging from the contents of the box. We find no difficulty in cooking 15 bushels of unground Indian corn in the tub, in the course of three or four hours, and with small expense of fuel. Fifty bushels of roots could be perfectly cooked in the box, in the same time. For swine, fattening cattle and sheep, milch cows and working horses, and perhaps oxen, we do not doubt a large amount of food may be saved by the use of such or a similar cooking apparatus. The box may be enlarged to treble the capacity of the foregoing, without prejudicing the operation, and even with a boiler of the same dimensions, but it would take a longer time to effect the object. If the boiler were increased in proportion to the box, the cooking process would of course be acccomplished in the same time.

The materials for farm buildings we have assumed to be of wood, from the abundance and cheapness of this material generally in the United States. Yet we would always prefer when not too expensive, or where the capital could be spared,

that brick or stone should take their place. They are more durable, are less exposed to fire, and they sustain a more equable temperature in the extremes of the seasons. Barns and, sheds cannot like houses, be conveniently made rat proof, but they may be so constructed as to afford them few hiding places, where they will be out of the reach of cats and terrier dogs, which are always indispensable around infested premises. These and an occasional dose of arsenic, carefully and variously disguised will keep their numbers within moderate bounds. If poison be given, it would be well to shut up the cats and terriers for three or four days until the object is effected, or they too might partake of it.

LIGHTNING RODS.

In the hot, dry weather of our American summers, thunder showers are frequent and often destructive to buildings. This danger is much increased for such barns as have just received their annual stores of newly cut hay and grain.—The humid gases driven off by the heating and sweating process, which immediatly follows their accumulation in closely packed masses, offers a strong attraction to electricity, just at the time when it is most abundant. It is then an object of peculiar importance to the farmer to guard his buildings with properly constructed lightning rods, and they are a cheap mode of insurance against fire from this cause, as the expense is trifling and the security great.

It is a principle of general application, that a rod will protect an object at twice the distance of its height, above any given point, in a line perpendicular to its upper termination. Thus a rod attached to one side of a chimney of four feet diameter, must have its upper point two feet above the chimney to protect it. The height above the ridge must be at least one half the greatest horizontal distance of the ridge from the perpendicular rod.

Materials and manner of construction.—The rod may be constructed of soft, round or square iron, the latter being preferable, in pieces of convenient length and of not less than ¾ of an inch in diameter. These should not be hooked into each other, but attached either by screwing the ends together, or forming a point and socket to be fastened by a rivet, so that the rod when complete, will appear as one continuous surface of equal size throughout. If a square rod be used, it will attract the electricity through its entire length, if the corners be notched with a single downward stroke of a sharp *cold*

chisel, at intervals of two or three inches. Each of these will thus become a point to attract and conduct the electricity to the earth. A bundle of wires, thick ribbons, or tubes of metal, would be much better conductors than an equal quantity of matter in the solid, round or square rods, as the conducting power of bodies, is in the ratio of their surface. No part of the rod should be painted, as its efficiency is thereby greatly impaired. The upper extremity may consist of one, two or more finely drawn points, which should be of copper, silver or well gilded iron, to prevent rusting. The lower part of the rod, at the surface of the ground, should terminate in two or three flattened, divergent branches, leading several feet outwardly from the building, and buried to the depth of perpetual moisture in a bed of charcoal. Both the charcoal and moisture are good conductors, and will ensure the passage of the electricity into the ground, and away from the premises. The rod may be fastened to the building by glass or well seasoned wood, boiled in linseed oil, then well baked and covered with several coats of copal varnish.

The conductors of electricity in the order of their conducting form, are copper, silver, gold, iron, tin, lead, zinc, platina, charcoal, black lead (plumbago,) strong acids, soot and lamp-black, metallic ores, metallic oxides, diluted acids, saline solutions, animal fluids, sea water, fresh water, ice above 0°, living vegetables, living animals, flame, smoke, vapor and humid gases, salts, rarified air, dry earth, and massive minerals. The non-conductors in their order, are shellac, amber, resins, sulpher, wax, asphaltum, glass, and all vitrified bodies including crystallised, transparent minerals, raw silk, bleached silk, dyed silk, wool, hair and feathers, dry gases, dry paper, parchment and leather, baked wood and dried vegetables.

CHAPTER XIV.

DOMESTIC ANIMALS—PRINCIPLES OF BREEDNIG, NUTRITION, MANAGEMENT, &c.

The principal domestic animals reared for economical purposes in the United States, are Horned or neat cattle, the Horse, the Mule, Sheep and Swine. A few Asses are bred, but for no other object than to keep up the supply of jacks for propagating mules. We have also goats, rabbits and the house domestics, the dog and cat; the two former, only in very limited numbers, but both the latter much beyond our legitimate wants. There have been a few specimens of the Alpaca imported, and an arrangement is now in progress for the introduction of a flock of several hundred, which if distributed among intelligent and wealthy agriculturists, as proposed, will test their value for increasing our agricultural resources. We shall confine ourselves to some general considerations connected with the first mentioned and most important of our domestic animals.

Their number as shown by the agricultural statistics collected in 1839, by order of our General Government, was 15,000,000 neat cattle; 4,335,000 horses and mules, (the number of each not being specified;) 19,311,000 sheep; and 26,300,000 swine. There is much reason to question the entire accuracy of these returns, yet there is doubtless an approximation to the truth. Sheep have greatly increased since that period, and would probably number the present year (1846,) not less than 28,000,000; and if our own manufactures continue to thrive, and we should moreover become wool exporters, of which there is now a reasonable prospect, an accurate return for 1850, will undoubtedly give us not less than 35,000,000 for the entire Union. There has been a great increase in the value of the other animals enumerated, but not in a ratio corresponding with that of sheep. This is

not only manifest in their numbers, but in the gradual and steady improvement of the species. It may be safely predicted, that, this improvement will not only be sustained, but largely increased, for there are some intelligent and spirited breeders to be found in every section of the country, whose liberal exertions and powerful examples are doing much for this object. Wherever intelligence and sound judgment are to be found, it will be impossible long to resist the effects of a comparison between animals, which on an equal quantity of the same food, with the same attention and in the same time, will return 50, 20, or even a less per cent. more in their intrinsic value or marketable product, than the ordinary class. This improvement has relatively been, most conspicuous in the western and southern states, not that the present average of excellence in their animals surpasses or even reaches that of the north and east; but the latter have long been pursuing this object, with more or less energy, and they have for many years had large numbers of excellent specimens of each variety; while with few exceptions, if we exclude the blood-horse or racing nag, the former have till recently, paid comparatively little attention to the improvement of their domestic animals. The spirit for improvement through extensive sections, is now awakened, and the older settled portions of the country may hereafter expect competitors, whose success will be fully commensurate with their own. Before going into the management of the different varieties, we will give some general principles and remarks applicable to the treatment of all.

The purpose for which animals are required, is first of consequence to be determined, before selecting such as may be necessary either for breeding or use. Throughout the north-eastern states, cows for the dairy, oxen for the yoke, and both for the butcher, are wanted. In much of the west and south, beef alone is the principal object, while the dairy is neglected, and the work of the ox is seldom relied on except for occasional drudgery. Sheep may be wanted almost exclusively for the fleece, or for the fleece and heavy mutton, or in the neighborhood of markets, for large, early lambs. The pastures and winter food, climate and other conditions, present additional circumstances, which should be well considered before determining on the particular breed, either of cattle or sheep, that will best promote the interest of the farmer. The kind of work for which the horse may be wanted, whether as a roadster, for the saddle, as a heavy team horse

or the horse of all work, must be first decided, before selecting the form or character of the animal. The range of pig excellence is more circumscribed, as it is only necessary to breed such as will yield the greatest amount of valuable carcass, within the shortest time, and with the least expense.

PRINCIPLES OF BREEDING.

All breeding is founded on the principle, that *like begets like.* This is however liable to some exceptions, and is much more generally true when *breeding down* than when *breeding up.* If two animals which can never be exactly similar in all respects, are requisite to the perpetuation of the species, it necessarily results, that the progeny must differ in a more or less degree from each parent. With wild animals and such of the domestic as are allowed to propagate without the interference of art, and whose habits, treatment and food are nearly similar to their natural condition, the change through successive generations is scarcely perceptible. It is only when we attempt to improve their good qualities, that it is essential, carefully to determine and rigidly to apply what are adopted as the present scientific principles of breeding. We cannot believe that we have penetrated beyond the mere threshold of this art. Unless then, we launch into experiments, which are necessarily attended with uncertainty, our duty will be, to take for our guide the most successful practice of modern times, until further discoveries enable us to modify or add to such as are already known and adopted. We may lay down then as the present rules for this art, 1st. That the animals selected for breed, should unite in themselves all the good qualities we wish to perpetuate in the offspring. 2d. These qualities, technically called *points*, should be in-bred in the animals as far as practicable, by a long line of descent from parents similarly constituted. The necessity for this rule is evident from the fact, that in mixing different species, and especially mongrels, with a long established breed, the latter will most strongly stamp the issue with its own peculiarities. This is forcibly illustrated in the case of the Devon cattle, an ancient race, whose color, form and characteristics are strikingly perpetuated, sometimes to the sixth or even a later generation. So far is this principle carried by many experienced breeders, that they will use an animal of indifferent external appearance, but of approved descent, (*blood*,) in preference to a decidedly superior one, whose pedigree is imperfect. 3d. All

the conditions of soil, situation, climate, treatment and food should be favorable to the object sought. 4th. As a general rule, the female should be relatively larger than the male. This gives ample room for the perfect development of the fœtus, easy parturition, and a large supply of milk for the offspring, at a period in its existence, when food has a greater influence in perfecting character and form than at any subsequent time. 5th. Exceptions to this rule may be made, when greater size is required than can be obtained from the female, and especially, when more vigor and hardiness of constitution are desirable. For this purpose, strong masculine development in the sire are proper, and if otherwise unattainable, something of coarseness may be admitted, as this may be afterwards corrected, and nothing will atone for want of constitution and strength. 6th. Pairing should be with a strict reference to correcting the imperfections of one animal, by a corresponding excellence in the other. 7th. *Breeding in-and-in*, or propagating from animals nearly allied, may be tolerated under certain circumstances, though seldom; and only in extreme cases between those of the same generation as brother and sister. When the animal possesses much stamina and peculiar merit, which it is desired to perpetuate in the breed, it may be done either in the ascending or descending line, as in breeding the son to the parent, or the parent to his own progeny. This has been practised with decided advantage, and in some cases has even been continued successively as low as the sixth generation. 8th. It is always better to avoid close relationship, by the selection of equally meritorious stock-getters of the same breed, from other sources. 9th. Wholesome, nutritious food, at all times sufficient to keep the animals steadily advancing, should be provided, but they must never be allowed to get fat. Of the two evils, starving is preferable to surfeit. Careful treatment and the absence of disease must be always fully considered. 10th. Animals should never be allowed to breed either too early or too late in life. These periods cannot be arbitrarily laid down, but must depend on their time of maturity, the longevity of the breed, and the stamina of the individual. 11th. No violent cross or mixing of distinct breeds should ever be admitted for the purposes of perpetuation, as of cattle of diverse sizes; horses of unlike characters; the Merino and long wools, or even the long or short and the middle wools. For carcass and

constitution, these crosses are unexceptionable; and it is a practice very common in this country, and judicious enough where the whole produce is early destined for the shambles. But when the progeny are designed for breeders, the practice should be branded with unqualified reprehension.

THE GENERAL FORM AND CHARACTERISTICS OF DOMESTIC ANIMALS.

Within certain limits, these may be reduced to a common standard. All animals should have a good head, well set up; a clean fine muzzle, and a bright, clear and full, yet perfectly placid eye. With the exception of the dog and cat, whose original nature is ferocity, and whose whole life, unless diverted from their natural instincts, is plunder and prey; and the jockey race-horse, which is required to take the purse, at any hazard of life or limb to the groom; a mild quiet eye is indispensable to the profitable use of the domestic brute. The neck should be well formed, not too long, tapering to its junction with the head, and gradually enlarging to a firm, well expanded attachment to the back, shoulders and breast. The back or chine should be short, straight and broad; the ribs springing out from the back bone nearly at right angles, giving a rounded appearance to the carcass, and reaching well behind to a close proximity to the hip; tail well set on, and full at its junction with the body, yet gradually tapering to fineness; thighs, fore-arms and crop, well developed; projecting breast or brisket; the fore-legs straight, and hind ones properly bent, strong and full where attached to the carcass, but small and tapering below; good and sound joints; dense, strong bones, but not large; plenty of fine muscle in the right places; and hair or wool fine and soft. The chest in all animals should be full, for it will be invariably found, that only such will do the most work, or fatten easiest on the least food.

The Lungs.—From the above principle, founded on long experience and observation, Cline inferred, and he has laid it down as an incontrovertible position, that the lungs should always be large; and Youatt expresses the same opinion. This is undoubtedly correct as to working beasts, the horse and the ox, which require full and free respiration, to enable them to sustain great muscular efforts. But later physiologists, Playfair and others, perhaps from closer and more accurate observations, have assumed that the fattening propensity is in the ratio of the smallness of the lungs. Earl Spencer

has observed, that this is fully shown in the pig, the sheep, the ox and the horse, whose aptitude to fatten and smallness of lungs, are in the order enumerated. This position is further illustrated, by the different breeds of the same classes of animals. The Leicester sheep have smaller lungs than the South Down; and it was found in an experiment made on Lord Ducie's example farm, that a number of the former, on a given quantity of food, and in the same time, reached 28 lbs. a quarter, while the South Downs with a greater consumption of food, attained in the same period, only 18 lbs. The Chinese pigs have much smaller lungs than the Irish, and the former will fatten to a given weight on a much less quantity of food than the latter. (*Playfair.*) The principle would seem to be corroborated by the fact, that animals generally fatten faster in proportion to the quantity of food they consume, as they advance towards a certain stage of maturity; during all which time, the secretion of internal fat is gradually compressing the size, by reducing the room for the action of the lungs. Hence the advantage of carrying the fattening beast to an advanced point, by which not only the quality of carcass is improved, but the quantity is relatively greater for the amount of food consumed. These views are intimately connected and fully correspond, with the principles of

RESPIRATION IN ANIMALS.

From careful experiments, it has been found, that all animals daily consume a much larger quantity of food than the aggregate of what may have been retained in the system, added to what has been expelled in the fœces and urine, and what has escaped by perspiration. Boussingault, who combines the characteristics of an ingenious chemist, a vigilant observer and a practical agriculturist, made an experiment with a "milch-cow and a full-grown horse, which were placed in stalls so contrived that the droppings and the urine could be collected without loss. Before being made the subjects of experiment, the animals were ballasted or fed for a month with the same ration that was furnished to them, during the three days and three nights which they passed in the experimental stalls. During the month, the weight of the animals did not vary sensibly, a circumstance which happily enables us to assume that neither did the weight vary during the seventy-two hours when they were under especial observation.

"The cow was foddered with after-math, hay and potatoes; the horse with the same hay and oats. The quantities of forage were accurately weighed, and their precise degree of moistness and their composition were determined from average samples. The water drunk was measured, its saline and earthy constituents having been previously ascertained. The excrementitious matters passed were of course collected with the greatest care; the excrements, the urine, and the milk were weighed, and the constitution of the whole estimated from elementary analyses of average specimens of each. The results of the two experiments are given in the table on the next page.

"The oxygen and hydrogen that are not accounted for in the sum of the products have not disappeared in the precise proportions requisite to form water; the excess of hydrogen amounts to as many as from 13 to 15 dwts. It is probable that this hydrogen of the food became changed into water by combining during respiration with the oxygen of the air."

FOOD CONSUMED BY THE HORSE IN 24 HOURS.

Forage.	Weight in the wet state.	Weight in the dry state.		Elementary matter in the food. Carbon.		Hydrogen.			Oxygen.			Azote.			Salts and Earths.		
	lbs.	lbs.	oz.	lbs.	oz.	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt	lb.	oz.	dwt.
Hay,	20	17	4	7	11	0	10	7	6	8	8	0	3	2	1	6	14
Oats,	6	5	2	2	7	0	3	18	1	10	14	0	1	7	0	2	10
Water,	43	..		..		..			..			..			0	0	8
Total,	69	22	6	10	6	1	2	5	8	7	2	0	4	9	1	9	12

PRODUCTS VOIDED BY THE HORSE IN 24 HOURS.

Products.	Weight in the wet state.			Weight in the dry state.			Elementary matter in the products. Carbon.			Hydrogen.			Oxygen.			Azote.			Salts and Earths.		
	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.
Urine,	3	6	15	9	9	14	0	3	10	0	0	7	0	1	2	0	1	4	0	3	10
Excrements,	38	2	2	9	5	6	3	7	17	0	5	15	3	6	14	0	2	10	1	6	10
Total,	71	8	17	10	3	0	3	11	7	0	6	2	3	7	16	0	3	14	1	10	0
Total matter of the food,	69	0	0	22	6	0	10	6	0	1	2	5	8	7	2	0	4	9	1	9	12
Difference,	27	3	3	12	3	0	6	6	13	0	8	3	4	11	6	0	0	15	0	0	8

WATER CONSUMED BY THE HORSE IN 24 HOURS.

	lbs.	oz.
With the hay,	2	3
With the oats,	0	14
Taken as drink,	35	3
Total consumed,	38	4

WATER VOIDED BY THE HORSE IN 24 HOURS.

	lbs.	oz.
With the urine,	2	6
With the excrements,	23	8
Total voided,	25	14
Water consumed,	38	4
Water exhaled by pulmonary and cutaneous transpiration,	12	6

FOOD CONSUMED BY THE COW IN 24 HOURS.

Fodder,	Weight in the wet state.			Weight in the dry state.			Elementary matter of the food. Carbon.			Hydrogen.			Oxygen.			Azote.			Salts and Earths.		
	lh.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.
Potatoes,	40	2	5	11	2	1	4	11	2	0	7	15	4	10	17	0	1	12	0	6	13
After math hay,	20	1	2	16	11	0	7	11	11	0	11	7	5	10	17	0	4	17	1	8	6
Water,	160	0	0	..			..			..			..			..			0	1	12
Total,	220	3	7	28	1	1	12	10	13	1	7	2	10	9	14	0	6	9	2	4	11

PRODUCTS VOIDED BY THE COW IN 24 HOURS.

Products.	Weight in the wet state.			Weight in the dry state.			Elementary matter in the products. Carbon.			Hydrogen.			Oxygen.			Azote.			Salts and Earths		
	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz.	dwt.	lb.	oz	dwt.	lh.	oz.	dwt.
Excrements,	76	1	9	10	8	12	4	7	0	0	6	13	4	0	9	0	2	19	1	3	8
Urine,	21	11	12	2	6	17	0	8	7	0	0	16	0	8	3	0	1	3	1	0	6
Milk,	22	10	10	3	1	0	1	8	3	0	3	3	0	10	6	0	1	9	0	1	16
Total,	120	11	11	16	4	9	6	11	10	0	10	12	5	6	18	9	5	11	2	5	10
" matter of food,	220	3	7	28	1	1	12	10	13	1	7	2	10	9	14	0	6	9	2	4	11
Difference,	99	3	16	11	8	12	5	11	3	0	8	10	5	2	16	0	0	18	0	0	19

WATER CONSUMED BY THE COW IN 24 HOURS.

	lbs.	oz.
With the potatoes,	23	12
With the hay,	2	9
Taken as drink,	132	0
Total consumed,	158	5

WATER VOIDED BY THE COW IN 24 HOURS.

	lbs.	oz.
With the excrements,	53	10
With the urine,	15	14
With the milk,	16	3
Total voided,	85	11
Water consumed,	158	5
Water passed off by pulmonary and cutaneous transpiration,	72	10

We here perceive a large loss of water, carbon, hydrogen, &c. Nearly all this loss of carbon and hydrogen, escaped by respiration, while most of the water, oxygen, nitrogen and salts, passed off in perspiration. In further illustration of the subject of respiration, Liebig says, "from the accurate determination of the quantity of carbon daily taken into the system in the food, as well as of that proportion of it which passes out of the body in the fœces and urine, *unburned*, that is, in some form uncombined with oxygen, it appears that an adult taking moderate exercise, consumes 13.9 oz. of carbon daily." The foregoing are facts in the animal economy, capable of vast practical bearing in the management of our domestic animals. But before following out these principles to their application, let us briefly examine

THE EFFECTS OF RESPIRATION.

We have seen from the experiment of Boussingault, that there is a loss of 6 lbs. 6 oz. of carbon, and 8 oz. of hydrogen in the food of the horse, and something less in that of the cow, every 24 hours, which has not been left in the system, nor has it escaped by the evacuations. What has become of so large an amount of solid matter? It has escaped through the lungs and been converted into air. The carbon and hydrogen of the food have undergone those various transformations which are peculiar to the animal economy, digestion, assimilation, &c., which it is not necessary, nor will our limits permit us here to explain; and they appear at last in the veinous blood, which in the course of its circulation, is brought into the cells of the lungs. The air inhaled, is sent through every part of their innumerable meshes, and is there separated from the blood, only by the delicate tissues or membranes which enclose it. A portion of the carbon and hydrogen escape from the blood into the air-cells, and at the instant of their contact with the air, they effect a chemical union with its oxygen, forming carbonic acid and the vapor of water, which is then expired, and a fresh supply of oxygen is inhaled. This operation is again repeated, through every successive moment of animal existence. Besides other purposes which it is probably designed to subserve, but which have hitherto eluded the keenest research of chemical physiology, one obvious result of it is, the elevation of the temprature of the animal system. By the ever-operating laws of nature, this chemical union of two bodies in the formation of a third, disengages latent heat, which taking place in contact

with the blood, is by it, diffused throughout the whole frame. The effect is precisely analogous to the combustion of fuel, oils, &c. in the open air.

Perspiration is the counteracting agent which modifies this result, and prevents the injurious effects which under exposure to great external heat, would insure certain destruction. And this too, it will have been seen, is provided at the expense of the animal food. When from excessive heat, caused by violent exercise or otherwise, by which respiration is accelerated and the animal temperature becomes elevated, the papillæ of the skin pour the limpid fluid through their innumerable ducts, which in its conversion into vapor, seize upon the animal heat and remove it from the system, producing that delicious coolness so grateful to the laboring man and beast in a sultry summer's day. These two opposing principles, like the antagonistic operations of the regulator in mechanics, keep up a perfect balance in the vital machine, and enable the entire division of the animal creation distinguished as warm blooded, including man and the brute, all the feathered tribes, the whale, the seal, the walrus, &c., to maintain an equilibrium of temperature, whether under the equator or the poles, on the peaks of Chimborazo, the burning sands of Zahara, or plunged in the depths of the Arctic Ocean.

The connexion between the size of the lungs, and the aptitude of animals to fatten, will be more apparent from the fact, that the carbon and hydrogen which are abstracted, constitute two of the only three elements of fat. The larger size, the fuller play, and the greater activity of the lungs, by exhausting more of the materials of fat, must necessarily diminish its formation in the animal system; unless it can be shown, which has never yet been done, that the removal of a porton of the fat-forming principles, accelerates the assimilation of the remainder.

The food which supplies respiration in the herbiverous animals, after they are deprived of the milk which furnishes it in abundance, is the starch, gum, sugar, vegetable fats and oils, which exist in the vegetables, grain and roots which they consume; and in certain cases where there is a deficiency of other food, it is sparingly furnished in woody and cellular fibre. All these substances constitute the principal part of dry vegetable food, and are made up of these elements, *which in starch, gum, cane-sugar and cellular fibre, exist in precisely the same proportions*, viz: 44 per cent. of carbon, 6.2 of hydrogen and 49.8 of oxygen. Grape sugar, woody

fibre, and vegetable and animal fats and oils are made up of the same elements, but in different proportions, the last containing much more carbon and hydrogen than those above specified. In the fattening animals, it is supposed the vegetable fats and oils are immediately transferred to the fat cells, undergoing only such slight modification as perfectly adapts them to the animal economy, while respiration is supplied by the other enumerated vegetable matters. If these last are taken into the stomach beyond the necessary demand for its object, they too are converted by the animal functions into fat, and are stored up in the system for future use. But if the supply of the latter is insufficient for respiration, it first appropriates the vegetable fat contained in the food; if this is deficient, it draws on the accumulated stores of animal fat already secreted in the system, and when these two are exhausted, it seizes upon what is contained in the tissues and muscle. When the animal commences drawing upon its own resources for the support of its vital functions, deterioration begins; and if long continued, great emaciation succeeds, which is soon followed by starvation and death. The carniverous animals are furnished with their respiratory excretions, from the animal fat and fibre which exist in their food, and which the herbivoræ had previously abstracted from the vegetable creation.

The circumstances which augment respiration are exercise, cold and an abundant supply of food. Exercise, besides exhausting the materials of fat, produces a waste of fibre and tissue, the muscular and nitrogenized parts of the animal system; and it is obvious from the foregoing principles, that cold requires a corresponding demand for carbon and hydrogen to keep up the vital warmth. The consumption of food to the fullest extent required for invigorating the frame, creates a desire for activity and it insensibly induces full respiration. The well-fed, active man unconsciously draws a full, strong breath; while the abstemious and the feeble, unwittingly use it daintily, as if it were a choice commodity not to be lavishly expended. If the first be observed when sleep has effectually arrested volition, the expanded chest will be seen heaving with the long-drawn sonorous breath; while that of the latter will exhibit the gentle repose of the infant on its mother's breast. The difference between the food of the inhabitants of the polar and equatorial regions, is strikingly illustrative of the demands both for breathing and

perspiration. The latter are almost destitute of clothing, and subsist on their light juicy tropical fruits, which contain scarcely 12 per cent. of carbon, yet furnish all the elements for abundant perspiration; the latter are imbedded in furs, and devour gallons of train oil or its equivalent of fat, which contains nearly 80 per cent. of carbon, that is burnt up in respiration to maintain a necessary warmth. The bear retires to his den in the beginning of winter, loaded with fat, which he has accumulated from the rich, oily mast abounding in the woods in autumn. There he lies for months, snugly coiled and perfectly dormant; the thickness of his shaggy coat, his dry bed of leaves and well protected den effectually guarding him from cold, which in addition to his want of exercise, draw slightly upon respiration to keep up the vital heat. When the stores of carbon and hydrogen contained in the fat are expended, his hunger and cold compel him to leave his winter quarters, again to wander in pursuit of food. Many of the swallow tribes in like manner, hybernate in large hollow trees, and for months eke out a torpid, scarcely perceptible existence, independent of food. Activity and full respiration on the return of spring, demand a support which is furnished in the myriads of flies they daily consume. The toad and frog have repeatedly been found in a torpid state, embedded in lime-stones, sand-stones and the breccias, where they were probably imprisoned for thousands of years without a morsel of food; yet when exposed to the warmth of the vital air and the stimulus of its oxygen, they have manifested all the activity of their species. This they are enabled to sustain only by an enormous consumption of insects. Dr. Playfair states, that in an experiment made by Lord Ducie, 100 sheep were placed in a shed, and ate 20 pounds of Swedes turneps each per day; another 100 were placed in the open air, and ate 25 pounds per day; yet the former, which had one-fifth less food, weighed, after a few weeks, three pounds more per head than the latter. He then fed five sheep in the open air between the 21st November and 1st December. They consumed 90 pounds of food per day, the temperature being at 44 degrees; and at the end of this time they weighed two pounds less than when first exposed. Five sheep were then placed under a shed, and allowed to run about in a temperature of 49 degrees. At first they consumed 82 pounds per day; then 70 pounds, and at the end of the time they had gained 23 pounds.

Again, five sheep were placed under a shed as before, and not allowed to take any exercise. They ate at first 64 pounds of food per day, then 58 pounds, and increased in weight 30 pounds. Lastly, five sheep were kept quiet and covered, and in the dark. They ate 3·5 pounds per day, and increased eight pounds.

Mr. Childers states, that 80 Leicester sheep in the open field, consumed 50 baskets of cut turneps per day, besides oil-cake. On putting them in a shed, they were immediately able to consume only 30 baske.s, and soon after but 25, being only half the quantity required before, and yet they fattened as rapidly as when eating the largest quantity. The minimum of food then, required for the support of animals, is attained when closely confined in a warm, dark shelter; and the maximum, when running at large, exposed to all weathers.

THE FOOD OF ANIMALS

Should be regulated by a variety of considerations. The young which may be destined for maturity, should be supplied with milk from the dam until weaning time. No food can be substituted for the well-filled udder of the parent, which is so safe, healthful and nutritious. If from any cause there is deficiency or total privation, it must be made up by that kind of food, meal-gruel, &c., which in composition approaches nearest in quality to the milk. At a more advanced age, or the time for weaning, grass, hay, roots or grain may be substituted, in quantities sufficient to maintain a steady, but *not a forced growth.* Stuffing can only be tolerated in animals which are speedily destined for the slaughter. Alternately improving and falling back is injurious to any animal. *An animal should never be fat but once.* Especially is high feeding bad for breeding animals. Much as starving is to be deprecated, the prejudicial effects of repletion are still greater. The calf or lamb intended for the butcher, may be pushed forward with all possible rapidity. Horses or colts should never exceed a good working or breeding condition.

Purposes fulfilled by different kinds of food.—The objects designed to be answered by food, are to a certain extent the same. All food is intended to meet the demands of respiration and nutrition, and fattening to a greater or less degree. But some are better suitted to one object than

others, and it is for the intelligent farmer to select such as are best for accomplishing his particular purposes. The very young animal requires large quantities of the phosphate of lime for the formation of bone; and this is yielded in the milk in larger proportions than from any other food. The growing animal wants bone, muscle and a certain amount of fat, and this is procured from the grasses, roots and grain; from the former when fed alone, and from the two latter when mixed with hay or grass. Horses, cattle and sheep, need hay to qualify the too watery nature of the roots, and the too condensed nutritiveness of the grain. Animals that are preparing for the shambles, require vegetable oils or fat, starch, sugar or gum. The first is contained in great abundance in flax and cotton-seed, the sun-flower and many other of the mucilaginous seeds. Indian corn is the most fattening grain. The potato contains the greatest proportion of starch, and the sugar beet has large quantities of sugar, and both consequently are good for stall-feeding. The ripe sugar-cane is perhaps the most fattening of vegetables, if we except the oily seeds and grain. The Swedes turnep is a good food to commence feeding to cattle and sheep, but where great ripeness in animals is desired, they should be followed with beets, carrots or potatoes and grain. The table of the average composition of the different crops, which we insert from Johnston, affords another view of the nutritive qualities of various kinds of food, before given from Boussingault, page 158, and from which it is principally abridged, and it will be found a valuable reference for their nutritive and fattening qualities. He says, "in drawing up this table, I have adopted the proportions of gluten, for the most part, from Boussingault. Some of them, however, appear to be very doubtful. The proportions of fatty matter are also very uncertain. With a few exceptions, those above given have been taken from Sprengel, and they are, in general, stated considerably too low. It is an interesting fact, that the proportion of fatty matter in and immediately under the husk of the grains of corn, is generally much greater than in the substance of the corn itself. Thus I have found the pollard of wheat to yield more than twice as much oil as the fine flour obtained from the same sample of grain. The four portions separated by the miller from a superior sample of wheat grown in the neighborhood of Durham, gave of oil respectively:—fine flour, 1·5 per cent.; pollard,

2·4; boxings, 3·6; and bran, 3·3 per cent. Dumas states that the husk of oats sometimes yields as much as five or six per cent. of oil." The columns under starch, &c., and fatty matter, denote the value for respiration or sustaining life and the fattening qualities; that under gluten, the capacity for yielding muscle and supporting labor; and saline matter indicates something of the proportions which are capable of being converted into bones.

	Water.	Husk or woody fibre	Starch, gum, and sugar.	Gluten, albumen, legumin, &c.	Fatty matter.	Saline matter.
Wheat, . . .	16	15	55	10 to 15	2 to 4 J.	2·0
Barley, . . .	15	15	60	12 ?	2·5 J.	2·0
Oats, ...	16	20	50	14·5 ?	5·6 J.	3·5
Rye, ...	12	10	60	14·5	3·0	1·0
Indian corn, .	14	15 ?	50	12·0	5 to 9 D.	1·5
Buckwheat, . .	16 ?	25 ?	50	14·5	0·4 ?	1·5
Beans, . . .	16	10	40	28·0	2 +	3·0
Peas, ...	13	8	50	24·0	2·8 ?	2·8
Potatoes, . .	75 ?	5 ?	12 ?	2·25	0·3	0·8 to 1
Turneps, . .	85	3	10	1·2	?	0·8 to 1
Carrots, . . .	85	3	10	2·0	0·4	1·0
Meadow hay, .	14	30	40	7·1	2 to 5 D.	5 to 10
Clover hay, . .	14	25	40	9·3	3·0	9
Pea straw, .	10 to 15	25	45	12·3	1·5	5
Oat, do. . .	12	45	35	1·3	0·8	6
Wheat, do. .	12 to 15	50	30	1·3	0·5	5
Barley, do. . .	do.	50	30	1·3	0·8	5
Rye, ...	do.	45	38	1·3	0·5	3
Indian corn, do.	12	25	52	3·0	1·7	4

This table, it will be perceived, is far from settling the *precise* relative value of the different enumerated articles. An absolute, unchanging value can never be assumed of any one substance, as the quality of each must differ with the particular variety, the soil upon which it is grown, the character of the season, the manner of curing, and other circumstances. An approximate relative value is all that can be expected, and this we may hope ere long to obtain, from the spirit of analytical research which is now developed and in successful progress. More especially do we need these investigations with *American products*, some of which are but partially cultivated in Europe, whence we derive most of our analyses. And many which are there reared, differ widely from those produced here, as these also differ from each other. What, for instance, is the character of *meadow hay?*

W. know that this varies as 4 to 1, according to the particu'ar kinds grown; and *our* Indian corn has certainly a less range than from 5 to 9.

THE CHANGES IN THE FOOD OF ANIMALS.—Potatoes when first ripe, are estimated to be worth for feeding purposes, nearly twice as much as when old; and we have seen that the relative value of the different kinds varies greatly at the same age and under similar conditions of growth. Perrault ascertained by careful experiment, that hay, clover and lucern lost much of their nutritive qualities by drying, and in lucern this loss amounted to about 35 per cent. This is an important consideration in the feeding of green and dry forage. Oats are among the best feed, both for young and working animals; but it has been found that they are greatly improved for the latter, and perhaps for both, by allowing the new crop to remain till the latter part of winter before feeding. The improvement by steaming and cooking food has been alluded to in a previous chapter. Food properly managed, can never be made worse by cooking for any animals, although it has not been considered so essential for working, and generally for ruminating animals, as for swine, and such as were stall-feeding. But the alteration produced in cooking, by fitting it for a more ready assimilation, must as a general rule, add much to the value of the food and the rapid improvement of the animal. The effect of slight fermentation or souring the food, produces the same result. Animals accustomed to this acid food, will reject what is unprepared when they can get at the former; and we have no doubt from our own experience, that there is a saving in thus preparing it, from 20 to 40 per cent. A mixture of food should be supplied to all animals. Like man, they tire of any constant aliment. For such, especially, as are fattening, and which it is desirable to mature with the greatest rapidity, a careful indulgence of their appetite should be studied, and it should be provided with whatever it most craves, if it be adapted to the secretion of fat. Cutting, crushing and grinding the food; cooking, souring and mixing it, are each by themselves an improvement in feeding, and frequently two or more of these preparations combined, are of great utility in effecting the object proposed.

THE PROFIT OF FEEDING, it is evident, consists in a valuable return from the animal of the food consumed. In the horse, this can only be received in labor or breeding; in the

ox, from labor and flesh; in the cow, from the milk, the flesh and her young. In the sheep, it may be returned in its fleece, its carcass or its progeny; and in the swine only by its progeny and flesh. The manure we expect from all; and if this be not secured and judiciously used, few animals about the farm will be found to yield a satisfactory profit for their food and attention; though it is evident, it should form but a small part of the return looked for. Animals are only profitable to the farmer when they yield a daily income, as in its milk or labor, or annually, by its young or fleece, unless it be in a course of regular improvement, either in its ordinary growth or preparation for the butcher. The animal must consume a certain amount of food merely to keep up its stationary condition, and to supply the materials for waste, respiration, perspiration and the evacuations. These must first be provided for in all cases before the farmer can expect any thing for the food. Frequent observation has shown, that an ox will consume about two per cent. of his weight of hay per day, to maintain his condition. If put to moderate labor, an increase of this quantity, to three per cent., will enable him to perform his work and still maintain his flesh. If to be fattened, he requires about 4½ per cent. of his weight daily, in nutritious food. A cow to remain stationary and give no milk eats two per cent. of her weight daily, and if in milk, she will consume three per cent. If these statements are correct, which it is certain they are in principle, though they may not be entirely in degree, it will require the same food to keep three yoke of cattle in idleness, as two at work, and the food of every two that are idle, will nearly support one under the most rapid condition of fatting. Two cows may be kept in milk with the same feed that will keep three without. No practice is more impolitic, than barely to sustain the stock through the winter, or a part of the year, as is the case in too many instances, and allow them to improve only when turned on grass in summer. Besides subjecting them to the risk of disease, consequent upon their privation of food, nearly half the year is lost in their use, or in maturing them for profitable disposal, when if one-third of the stock had been sold, the remainder would have been kept in a rapidly improving condition, and at three years of age, they would probably be of equal value as otherwise at five or six. It is true that breed has much to do with

this rapid advancement, but breed is useless without food to develop and mature it.

CHAPTER XV.

NEAT OR HORNED CATTLE.

The value of our neat cattle exceeds that of any other of the domestic animals in the United States, and they are as widely disseminated and more generally useful. Like the sheep and all our domestic brutes, they have been so long and so entirely subject to the control of man, that their original type is unknown. They have been allowed entire freedom from all human direction or restraint for hundreds of years, on the boundless pampas of South America, California and elsewhere ; but when permitted to resume that natural condition, by which both plants and animals approximate in character to their original head, they have scarcely deviated in any respect from the domestic herds from which they are descended. From this it may be inferred, that our present races do not differ in any of their essential features and characteristics from the original stock.

VARIOUS DOMESTIC BREEDS.

Cultivation, feed and climate, have much to do in determining the form, size and character of cattle. In Lithuania, cattle attain an immense size, with but moderate pretensions to general excellence, while the Irish Kerry and Scotch Grampian cows but little exceed the largest sheep ; yet the last are compact and well-made, and yield a good return for the food consumed. Every country and almost every district has its peculiar breeds, which by long association have become adapted to the food and circumstances of its position, and when found profitable, they should be exchanged for

others, only after the most thorough trial of superior fitness for the particular location, in those proposed to be introduced. More attention has been paid to the improvement of the various breeds of cattle in England than in any other country; and it is there they have attained the greatest perfection in form and character, for the various purposes to which they are devoted. We have derived directly from Great Britain, not only the parent stock from which nearly all our cattle are descended, but also most of those fresh importations, to which we have looked for improvement on the present race of animals. A few choice Dutch cattle, generally black and white, and of large size, good forms and good milkers, with a decided tendency to fatten, have been occasionally introduced among us, but not in numbers sufficient to keep up a distinct breed; and in the hands of their importers or immediate successors, their peculiar characteristics have soon become merged in those herds by which they were surrounded. Some few French and Spanish cattle, the descendants of those remote importations, made when the colonies of those kingdoms held possession of our northern, western and southern frontiers, still exist in those sections; and although possessing no claims to particular superiority, at least in any that have come within our notice, yet they are so well acclimated, and adapted to their various localities, as to render it inexpedient to attempt supplanting them, except with such as are particularly meritorious.

NATIVE CATTLE.—This is a favorite term with Americans, and comprehends every thing in the country excepting such as are of a pure and distinct breed. It embraces some of the best, some of the worst, and some of almost every variety, shape, color and character of the Bovine race. The designation has no farther meaning, than that they are indigenous to the soil, and do not belong to any well defined or distinct variety. The best native cattle of the Union, are undoubtedly to be found in the north-eastern states. Most of the early emigrant cattle in that section, were from the southern part of England, where the Devon cattle abound, and though not bearing a close resemblance to that breed, unless it has been impressed upon them by more recent importations; yet a large number have that general approximation in character, features and color, which entitles them to claim a near kindred with one of the choicest cultivated breeds. They have the same symmetry, but not in general the excessive delicacy

of form which characterizes the Devons; the same intelligence, activity and vigor in the working cattle, and the same tendency to fattening; but they are usually better for the dairy than their imported ancestors. Some valuable intermixtures have occasionally been made among them. There have been many brindle cattle widely disseminated, of great merit as workers, and not often surpassed for the dairy and shambles. The Herefords have in a few instances been introduced among the eastern cattle, and apparently with great improvement. The importation made by Admiral Coffin, of four choice Hereford bulls and cows, which were presented to the State Ag. Soc. of Massachusetts, nearly thirty years since, is especially to be mentioned, as resulting in decided benefit wherever they were disseminated. Some of the old Yorkshire, or as they are sometimes styled, the long-horned Durhams, have been introduced, though these have been isolated individuals and never perpetuated as a separate breed. A few small importations have been made of the Short Horns and Ayrshires, but neither of these have been bred in the New England states in distinct herds to any extent. Their *native breed* has hitherto, and generally with good reason, possessed claims on the attention of their owners, which (with some slight exceptions) it has not been in the power of any rivals to supplant. With entire adaptedness to the soil, climate and wants of the farmer, an originally good stock has been carefully fostered, and the breeding animals selected with a strict reference to their fitness for perpetuating the most desirable qualities. As a consequence of this intelligent and persevering policy, widely, but not universally pursued, they have a race of cattle, though possessing considerable diversity of size and color, yet coinciding in a remarkable degree in the possession of those utilitarian features, which so justly commend them to our admiration.

In proceeding south-westwardly through New York, New Jersey, and elsewhere, we shall find in this branch of stock, a greater diversity and less uniform excellence; though they have extensive numbers of valuable animals. Here and there will be found a choice collection of some favorite foreign breed, which emigrants have brought from their native home, as did the Pagan colonists, their penates or household gods, the cherished associates of early days, and the only relics of their father land. Such are an occasional small herd of polled or hornless cattle, originally derived from Suffolk or Galloway, excellent both for the dairy and shambles; the Kyloe, or West

Highland (Scottish,) a hardy animal, unrivalled for beef; the Welsh runt; the Irish cattle; the crumpled horn Alderney, and some others.

THE DEVON is among the oldest distinctly cultivated breeds in this country, as he undoubtedly is of England, and probably he is the most universal favorite. This popularity is well deserved, and it is based upon several substantial considerations. They are beautifully formed, possessing excessive fineness and symmetry of frame, yet with sufficient bone and muscle to render them perfectly hardy, and they are among the most vigorous and active of working cattle. They have great uniformity of appearance in every feature, size, shape, horns and color. The cows and bulls appear small, but the ox is much larger, and both that and the dam, on cutting up, are found to weigh much beyond the estimates which an eye accustomed only to ordinary breeds, would have assigned to them. The flesh is finely marbled or interspersed with alternate fat and lean, and is of superior quality and flavor. The cows invariably yield milk of great richness, and when appropriately bred, none surpass them for the quantity of butter and cheese it yields. Mr. Bloomfield, the manager of the late Lord Leicester's estate at Holkham, has, by careful attention, somewhat increased the size without impairing the beauty of their form, and so successful has he been in developing their milking properties, that his average product of butter from each cow, is 4 lbs. per week for the whole year. He has challenged England to milk an equal number of cows of any breed, against 40 pure Devons, to be selected out of his own herd, without as yet having found a competitor. Although this is not a test of their merits, and by no means decides their superiority, yet it shows the great confidence reposed in them by their owner. The Devon ox under six years old, has come up to a nett dead weight of 1,593 lbs., and at three years 7 months to 1,316 lbs., with 160 lbs. of rough tallow.

Description.—The Devon is of medium size, and so symmetrical as to appear small. The color is invariably a deep, mahogany red, with usually a white udder and strip under the belly, and the tuft at the end of the tail is red in the calves, but white in the older animal. The head is small, broad in the forehead, and somewhat indented. The muzzle is delicate, and both the nose and the rings around the eye in the pure breed, are invariably of a bright, clear, orange. The cheeks and face are thin and fleshless; the horns clear, smooth, and of a yellowish white, handsomely curved upwards. The neck

is small and delicate at its junction with the head, but is well expanded in its attachment to the breast and shoulders. The last has the true slant for working, activity and strength, in which it excels all other breeds of equal weight. The barrel is round and deep, with a projecting brisket. The back is broad and level; the flank full; narrow hips; the rumps long, and the quarters well developed, and capable of holding a great quantity of the most valuable meat. The tail is on a level with the back, and gracefully tapers like a drum-stick, to the tuft on the end. The legs are of peculiar delicacy and fineness, yet possess great strength. The skin is of medium thickness, of a rich orange hue, pliable to the touch, and covered with a thick coating of fine, soft curly hair. The Devon is intelligent, gentle and tractable; is good for milk, and unsurpassed for the yoke and for fattening. No animal is better suited to our scanty or luxuriant hill pastures than the Devon, and none make a better return for the attention and food received. They insure a rapid improvement when mixed with other cattle, imparting their color and characteristics in an eminent degree. Several importations have been made into this country within the last 30 years, of the choicest animals, and though not yet numerous in the United States, we possess some of the best specimens that exist.

The short horns or Durhams are decidedly the most showy and taking among the cattle species. They are of all colors between a full, deep red, and a pure creamy white; but generally have both intermixed in larger or smaller patches, or intimately blended in a beautiful roan. Black, brown or brindled are not recognized among pure bred Short Horns. Their form is well-spread, symmetrical and imposing, and capable of sustaining a large weight of valuable carcass. The horn was originally branching and turned upward, but now frequently has a downward tendency, with the tips pointing towards each other. They are light and comparatively short, clear, highly polished and waxy. The head is finely formed, with a longer face but not so fine a muzzle as the Devon. The neck is delicately formed without dewlap; the brisket projecting, and the great depth and width of the chest giving short, well-spread fore legs. The crops are good; back and loin broad and flat; ribs projecting; deep flank and twist; tail well set up, strong at the roots and tapering. They have a thick covering of soft hair, and are mellow to the touch, technically termed *handling well.* They mature early and rapidly for the quantity of food consumed, yielding largely of

good beef with little offal. As a breed, they are excellent milkers, though some families of the short horns surpass others in this quality. They are inferior to the Devons, in their value as working oxen and in the richness of their milk. The Short Horns are assigned a high antiquity, by the oldest breeders in the counties of Durham and Yorkshire, England, the place of their origin, and for a long time, of their almost exclusive breeding. From the marked and decided improvement which they stamp upon other animals, they are evidently an ancient breed, though much the juniors of the Devon and Hereford. Their highly artificial style, form and character are unquestionably the work of deeply studied and long continued art; and to the same degree that they have been moulded in unresisting compliance with the dictation of their breeders, have they departed from that light and more agile form of the Devon, which conclusively and beyond the possibility of contradiction, mark the more primitive race.

The importation of Short Horns into this country is claimed to have been previous to 1783. They are the reputed ancestors of many choice animals existing in Virginia, in the latter part of the last century, and which were known as the *milk breed;* and some of these, with others termed the *beef breed,* were taken into Kentucky by Mr. Patton, as early as 1797, and their descendants, a valuable race of animals, were much disseminated in the west, and known as the *Patton stock.* The first authentic importations we have recorded, are those of Mr. Heaton, into Westchester, N. Y., in 1791 and '96, from the valuable herds of Messrs. Culley and Colling, which consisted of several choice bulls and cows. These were for many years bred pure, and their progeny was widely scattered. (*American Herd Book.*) They were also imported into New York, by Mr. Cox, in 1816; by Mr. Bullock, in 1822; by the late Hon. S. Van Rensselaer in 1823, and immediately after by Mr Charles Henry Hall, of Harlaem. Some small importations were made into Massachusetts between 1817 and '25, by several enterprising agriculturists, Messrs. Coolidge, Williams, and others; into Connecticut by Mr. Hall and others; into Pennsylvania by Mr. Powell; and into Ohio and some other states, by various individuals early in the present century. Since the first importations, larger accessions from the best English herds have been frequently made, and with the nice regard for pedigrees which the introduction of the herd book, and careful purity in breeding has produced, the Short Horns have become the

most extensive pure-bred family of cattle in the United States.

During the speculative times of 1835 to 1840, they brought high prices, frequently from $500 to $1000, and sometimes more. The following years of pressure, reduced their market price below their intrinsic value, but the tide is again turning, and they are now in some demand, but still at prices far below their utility and merits. They have from the first, been favorites in the rich, corn vallies of the West, their early maturity and great weight giving them a preference over any other breed. The only drawback to this partiality, is their inability from their form and weight, to reach remote eastern markets in good condition; an inconvenience now in a great measure remedied, by the recent remission of duties on foreign beef in the English market, which makes them of nearly equal value where fed, to pack for exportation. On light lands and scanty pastures they will probably never be largely introduced. All heavy animals require full forage within a limited compass, so as to fill their stomachs at once, and quietly compose themselves to their digestion.

The weights reached by the Short Horns in England, as given by Mr. Berry, have been enormous. Two oxen, six years old, weighed nett, 1820 lbs. each. A heifer of three years, and fed on grass and hay alone, weighed 1260 lbs. A four-year-old steer, fed on hay and turneps only, dressed 1890 lbs. A cow reached the prodigious weight of 1778 lbs. A heifer, running with her dam, and on pasture alone, weighed at seven months, 476 lbs. An ox, seven years old, weighed 2362 lbs. From their comparatively small numbers in this country, most of them have been retained for breeders, and few have as yet been fattened, and such only as were decidedly inferior. The animals which have been extensively produced by crossing upon our former stocks, have given evidence of great and decided improvement; and the Short Horns, and their grade descendants are destined at no distant day, to occupy a large portion of the richest feeding grounds in the United States.

Herefords are the only remaining pure breed, which has hitherto occupied the attention of graziers in this country. Like the Devons, they are supposed to be one of the most ancient races of British cattle. Marshall gives the following description: "The countenance pleasant, cheerful, open; the forehead broad; eye full and lively; horns bright, taper, and spreading; head small; chap lean; neck long and tapering;

chest deep; bosom broad, and projecting forward; shoulder-bone thin, flat, no way protuberant in bone (?), but full and mellow in flesh; chest full; loin broad; hips standing wide, and level with the chine; quarters long, and wide at the neck; rump even with the level of the back, and not drooping, nor standing high and sharp above the quarters; tail slender and neatly haired; barrel round and roomy; the carcase throughout deep and well spread; ribs broad, standing flat and close on the outer surface, forming a smooth, even barrel, the hindmost large and full of length; round bone small, snug, and not prominent; thigh clean, and regularly tapering; legs upright and short; bone below the knee and hock small; feet of middle size; flank large; flesh everywhere mellow, soft, and yielding pleasantly to the touch, especially on the chine, the shoulder, and the ribs; hide mellow, supple, of a middle thickness, and loose on the neck and huckle; coat neatly haired, bright and silky; color, a middle red, with a bald face characteristic of the true Herefordshire breed."

Youatt further describes them as follows: "They are usually of a darker red; some of them are brown, and even yellow, and a few are brindled; but they are principally distinguished by their white faces, throats, and bellies. In a few the white extends to the shoulders. The old Herefords were brown or red-brown, with not a spot of white about them. It is only within the last fifty or sixty years that it has been the fashion to breed for white faces. Whatever may be thought of the change of color, the present breed is certainly far superior to the old one. The hide is considerably thicker than that of the Devon, and the beasts are more hardy. Compared with the Devons, they are shorter in the leg, and also in the carcase; higher, and broader, and heavier in the chine; rounder and wider across the hips, and better covered with fat; the thigh fuller and more muscular, and the shoulders larger and coarser. They are not now much used for husbandry, although their form adapts them for the heavier work; and they have all the honesty and docility of the Devon ox, and greater strength, if not his activity. The Herefordshire ox fattens speedily at a very early age, and it is therefore more advantageous to the farmer, and perhaps to the country, that he should go to market at three years old, than be kept longer as a beast of draught. They are not as good milkers as the Devons. This is so generally acknowledged, that while there are many dairies of

Devon cows in various parts of the country, a dairy of Herefords is rarely to be found. To compensate for this, they are even more kindly feeders than the Devons. Their beef may be objected to by some as being occasionally a little too large in the bone, and the fore-quarters being coarse and heavy; but the meat of the best pieces is often very fine-grained and beautifully marbled. There are few cattle more prized in the market than the genuine Herefords."

There have been several importations of the Herefords into the United States, which by crossing with our native cattle, have done great good; but with the exception of a few fine animals at the South, we are not aware of their being kept in a state of purity, till the importation of the splendid herd, within the last six years, by Messrs. Corning and Sotham of Albany, N. Y. These Herefords are among the very best which England can produce, and come up fully to the description of the choicest of the breed. Mr. Sotham, after an experience of several years, is satisfied with the cows, for the dairy, and he has given very conclusive published statements of the results of their milking qualities, from which it may be properly inferred, that Youatt drew his estimates from some herds which were quite indifferent in this property. They are peculiarly the grazier's animal, as they improve rapidly and mature early on medium feed. They are excelled for the yoke, if at all, only by the Devons; which in some features they strongly resemble. Both are probably divergent branches of the same original stock.

The Ayrshire is a breed that has been much sought after of late years, from their reputation for fine dairy qualities. The milk is good both in quantity and quality, yielding, according to a recent statement of Mr. Tennant, of Scotland, who owns a large herd, 15 quarts per day during the best of the season, 12 of which made a pound of butter. The product of the latter averages about 170 pounds per annum to each cow. Another authority says, on the best low-land pasture, a good cow yields nearly 4000 quarts per year. This is a large quantity, and implies good cows and extra feed. Mr. Cushing, of Masssachusetts, who imported several select animals, without regard to their cost, informed us after three or four years trial, that he did not perceive any superiority in them, over the good native cows of that state, for dairy purposes. A large number have been imported in detached parcels, and scattered through the country. They are good animals, but seem to combine no valuable properties in a higher de-

gree than are to be found in our own good cattle, and especially such as are produced from a cross of the Short Horn bull of a good miking family, on our native cows. They are evidently a recent breed, and do not therefore possess that uniformity of appearance and quality which attaches to one of long cultivation. Mr. Aiton, of Scotland, gives the following account of them: "The dairy breed of Scotland have been formed chiefly by skilful management, within the last 50 years; and they are still improving and extending to other countries. Till after 1770, the cows in Cunningham were small, ill-fed, ill-shaped, and gave but little milk. Some cows of a larger breed and of a brown and white color, were about that time brought to Ayrshire from Teeswater, and from Holland, by some of the patriotic noblemen of Ayrshire; and these being put on good pasture, yielded more milk than the native breed, and their calves were much sought after by the farmers."

We may fairly infer from the foregoing, which is deemed indisputable authority; from the locality of their origin, in the neighborhood of the Short Horns; and from their general resemblance, both externally and in their general characteristics to the grade animals, that they owe their principal excellence to this long established breed.

MANAGEMENT OF CALVES.

The safest and least troublesome manner of raising calves, is at the udder of the dam; and whenever the milk is converted into butter and cheese, we believe this to be the most economical. The milk of one good cow is sufficient, with a run of fresh, sweet pasture, to the feeding of two calves at the same time, and if we allow the calves to arrive at three or four months of age before weaning, we may safely estimate, that one good cow will yield a quantity of milk in one season, fully equivalent to bringing up four calves to a weaning age. By keeping the calf on the fresh milk, whether he take it directly from the udder, or warm from the pail, all risk of disordered bowels is avoided. The milk is precisely adapted to the perfect health and thrift of the young, and whenever we substitute for it any other food, we must watch carefully that not the slightest mismanagement produces disorder, lest more is lost by disease or want of improvement, than is gained by the milk of which they are robbed.

The first milk of the cow after calving, is slightly purgative, which is essential to cleanse the stomach of the calf. It is

moreover perfectly worthless, for two or three days, for any other purpose except for swine. The calf will seldom take all the milk at first, and whatever is left in the bag should be thoroughly removed by the hand. If the calf is destined for the butcher, he must have all the milk he wants for at least six weeks, and eight or ten is better; and if the cow does not furnish enough, he ought to be fed gruel or linseed tea. He must be closely confined in a snug, but clean and airy stable, and the darker this is, and the more quiet he is kept, the more readily he will fatten. If designed to be reared, the safest and least troublesome method, is to keep the calf on new milk. If saving the milk be an object, it is still doubtful whether it is not better that he should have a part of it fresh from the cow, and depend for his remaining food on a good grass or clover pasture, meal or roots. Some farmers never allow the calf to approach the dam, but take it when first dropped, and put a handful of salt in its mouth, which is daily repeated till he is put to grass. This has a purgative effect, similar to the first milk. Flax-seed is then prepared by boiling a pint in four to six quarts of water, and diluted with hay tea till rather thicker than milk, and fed at blood heat. Hay tea is made, by boiling a pound of sweet, well cured clover, in one and a half gallons of clean water. As the calf becomes older, oat, barley, rye or Indian meal may be scalded and added to the flax seed. A better way when the skim milk is of little consequence, is to withdraw him from the cow after three or four days, then scald the milk, adding a little oat meal, and cool to the natural temperature of the milk, and feed it. Oats, either crushed or ground, is the best and safest grain for all young stock. The milk should not stand more than half a day before feeding to young calves. As they advance in age, it may be fed rather older, but should never be allowed to become sour; nor should it ever be fed cold. Connected with this feed, should be a good range of short, sweet pasture, and shelter against both sun and storms. If expedient, at about 10 weeks old, he may be safely weaned, but four months nursing is better for the calf. If allowed too much milk for several months, it is injurious to the future development of the young. It does not distend the stomach properly, nor call into use its ruminating habits. Calves thus brought up, have often proved light bellied, indifferent feeders, and decidedly inferior animals. When the calf is removed from the cow, they should be effectually separated from sight and hearing, as recognition create uneasiness, and is

an impediment to thrift in both. If there be any deficiency of suitable pasture for the calf, a small rack and trough should be placed under the shed in his range, and fine hay put in the former, and wheat bran or oat meal with a little salt, in the latter. It is also well to have resin within its reach, and if inclined to scour, add a little rennet to its food; if costive, administer pork broth. For disordered bowels, mix 2 dr. rhubarb, 2 oz. castor oil, and ½ dr. ginger, with a little warm milk or gruel; or give 2 oz. castor oil alone, or three oz. of Epsom salts. A homely remedy for scours, is to administer half a pint of cider, and as much blood taken from the calf's neck. Calves, like all young stock, should be allowed to change their feed gradually, from new milk to skimmed, or from the latter to other food. Their stomachs are delicate, and need gentle, moderate changes, when necessary to make them at all. Much depends on the care and attention they receive. A comfortable shelter, with a dry, warm bed, suitable food, regularly given three times a day at blood heat, and keeping the stomach in proper order, will do much to bring them forward rapidly, and with a small expenditure of food. The calf requires to be supplied through the winter with an abundance of fine, sweet hay and roots, the latter either chopped or mashed by a roller, with the addition of a trifle of meal or oats, and a full supply of salt and pure water. When there are larger animals on the premises, the calves ought to be kept by themselves. They should be sustained on their winter feed the following spring, until the grass furnishes a good bite on a well-compacted sod. The change from hay to grass must be gradual, unless the latter is considerably matured. The extreme relaxation of the bowels from the sudden change, frequently produces excessive purging. A slight and temporary relax from the early spring grass, is not objectionable.

Breeding.—The young animals should never be put to breeding under 15 months old, so as to bring their first calf at two years old; nor then, unless they have large size and good feed. Much depends on the progress towards maturity, and the supply of food in selecting the proper time for breeding. Some are as ready for this at a year and a half, as others are at three. Early breeding gives delicacy and symmetry to the form of the heifer, but it checks its growth, and when it is found to put her back too much, she may be allowed to rest for a few months, or even a year, to bring her up to the desired standard. These remarks apply principally to choice

breeding, or as it is some times termed *fancy stock.* For ordinary milch cows which have been moderately fed, three years is a proper age to come in, after which they must be milked as regularly, and as late before drying as possible.

Breaking Steers should be commenced when two or three years old. Some begin with the calf, accustoming him to a light yoke and occasional training. This practice will do as a pastime for trustworthy boys, as it makes them gentle and manageable afterwards, but is hardly worth a man's time. If always carefully handled when young, they will be found tractable. They should at first be placed behind a pair of well-broke cattle, nor should they be put to hard labor until quite grown, strong and perfectly accustomed to the yoke. If properly managed, cattle may be trained with all the docility, intelligence and much of the activity of the horse. That they are not is more frequently the fault of their masters.

Management of Oxen.—To procure perfect working cattle, it is necessary to begin with the proper breed. Many parts of the country will furnish such as are well suited to this purpose. A strong dash of Devon or Hereford blood is desirable when it needs to be improved. A well-formed, compact, muscular body; clean sinewy limbs; strong dense bones; large well-formed joints, with a mild expressive eye, is essential for good working oxen. After breaking, they must be led along gently, and taught before they are required to perform their task, and never put to a load which they cannot readily move, nor dulled by prolonging exertion beyond that point when it becomes irksome. A generous diet is necessary to keep up the spirit and ability of cattle, when there is hard work to be done. The horse and mule are fed with their daily rations of grain when at hard service, and if the spirit of the ox is to be maintained, he should be equally well fed, when as fully employed. Great and permanent injury is the result of niggardly feeding and severe toil, exacted from the uncomplaining animal. His strength declines, his spirit flags, and if this treatment be continued, he rapidly becomes the stupid, moping brute, which is shown off in degrading contrast to the more spirited horse, that performs, it may be, one half the labor, on twice his rations. The ox should be as little abused by threats and whipping, as by stinted feed and overtasked labor. Loud and repeated halloing, or the severe use of the lash, is as impolitic, as it is cruel and disgraceful. We never witness this barbarity without wishing

the brutes could change places, long enough at least to teach the biped, that humanity by his own sufferings, which his reason and sensibility have failed to inspire. Clear and intelligible, yet low and gentle words, are all that are necessary to guide the well-trained, spirited ox. The stick, or whip is needed rather to indicate the precise movement desired, than as a stimulant, or means of punishment. The ox understands a moderate tone more perfectly than a boisterous one; for all sounds become indistinct as they augment. He loses his sensitiveness as the drivers voice increases, till at last he becomes almost as brutal. It is of great advantage to have oxen well trained to *backing*. They may soon be taught by beginning with an empty cart on a descent; then on a level; then with an increasing load, or up-hill, till the cattle will back nearly the same load they will draw. Some oxen have a bad trick of *hauling* or *crowding*. Changing to opposite sides, longer or shorter yokes, and more than all, gentle treatment are the only remedies, and those not unfrequently fail. Cattle will seldom contract this habit, in the hands of a judicious, careful driver. *The yokes* should be carefully made and set easy, and the bows fitted to the necks and properly attached to the yoke. Cattle are liable to sore necks if used in a storm, and when subject to this exposure, they must be well rubbed with grease, where the yoke chafes them, and respite from work should be alowed till the necks heal.

THE PROPER TIME FOR TURNING OFF CATTLE, must depend on their previous feeding and management, the breed, and the purposes required. The improved breeds and many of their crosses, will mature for the butcher as fully at three or four, as inferior cattle at five to seven years old. If pushed rapidly with proper food, they will of course be *ripe* much sooner than if stinted. When cattle have to be purchased for work, or cows for the dairy, it becomes an object to keep them as long as they can be made profitable, and yet be turned off for fattening at a fair price. We have seen active and spririted oxen in the yoke at 16 or 17; but they seldom do as well after 12 or even 10 years. Old cattle are liable to more diseases than young, are less hardy, and recover more slowly when exposed to scanty feed or hard usage. They also fatten with more difficulty, and their meat is inferior. When they can be sold advantageously to the feeder, and replaced without inconvenience, it is found to be most profitable to turn them off at 7 or 8 years. They will by that time have attained full maturity, they will feed rapidly, and make the

largest amount of good beef. If there are extraordinary milkers among the cows, or first-rate workers among the oxen, it is better to keep them as long as they maintain their full vigor.

FATTENING CATTLE.—Such as are designed for the shambles the ensuing fall or winter, may be allowed to do their spring's labor; or if cows, they may be milked into summer after calving, or go farrow during the previous year. They should early be put on the best summer feed, which is better to be occasionally changed, to give variety and freshness, and keep the animal in good appetite. Let the fattening animals have the best, and after they have cropped it a while, give them a fresh field, and the other animals or sheep, can follow and clear off the remaining herbage, preparatory to shutting it up for a new growth. Some prefer an extensive range of rich feed, which is unchanged throughout the season, and when it is not necessary to divide the pasture with the other animals, this is a good practice.

The selection of animals for stall fattening is a nice point, and none without a practised eye and touch, can choose such as will make the best return for the food consumed. The characteristics of choice animals heretofore enumerated, are particularly essential in those intended for profitable fattening. But the most important of all is that firm mellowness, and quick elasticity of touch, which unerringly marks the kindly feeder and profitable bullock. When other means for ascertaining fail, it is a safe rule to select the best conditioned animals, out of a herd of grass-fed; for if all were of equal flesh and health, when turned out, those which have thriven most on their summer pasture, will generally fatten quickest on their fall and winter keep. Only the best should be selected. The remainder after consuming the coarser forage, may be at once disposed of for early use. From repeated trials it is found that the carcass of stall-fed animals will barely return the value of the materials consumed, and their manure is generally the only compensation for the time and attention bestowed. None but choice, thrifty beasts will pay for their food and attention, and all others will make their best returns, by an immediate disposal after the surplus fodder is gone.

Stall-feeding ought to be commenced early in the season. An ox may be fed in a box stall, or if accustomed to a mate, they do better by tying together with sufficient room, yet not so near as to allow of injuring each other. The building should be warm, but not hot; well ventilated, yet having on

current of cold air passing through; and as dark as possible. The stall ought to be kept clean and dry, and a deep bed of clean straw is of decided advantage. The ox should be first fed the inferior and most perishable roots with his grain and dry forage, and his food should be gradually increased in richness as he advances towards maturity. The food and water should be given three times a day, from thoroughly cleaned mangers or troughs. The animal likes a change of food, in which he should be indulged as often as may be necessary. If he refuses his food, a temporary privation, or variety is essential. When the food is changed, he should be moderately fed at first, till he becomes accustomed to it, as there is otherwise danger of cloying, which is always injurious. The moment the animal has done feeding, the remainder of the food ought to be at once removed. He then lies down, and if undisturbed, rests quietly till the proper hour induces him again to look for his accustomed rations. Regularity in the time of feeding, is of the utmost consequence. An animal soon becomes habituated to a certain hour, and if it be delayed beyond this, he is restless and impatient, which are serious obstacles to speedy fattening.

DISEASES IN CATTLE.

Our limits preclude more than a bare mention of remedies for some of the most common diseases.

Hoven, or swelling of the paunch, is a temporary ailment, caused by eating too freely of uncut and generally wet clover, or other succulent food. The animal gorges the first stomach, with so much food, that its contents cannot be expelled. Inflammation of the membrane takes place, and decomposition of the food soon follows. This is known by the distension of the paunch, and difficulty of breathing, and unless speedily relieved, suffocation and death will ensue. Both sheep and cattle are subject to it.

Remedies.*—In its early stages, when not too severe, it has been removed by administering some one of the following remedies. A pint of gin poured down the throat; from one to two pints of lamp or other oil; strong brine; new milk with one fifth its bulk of tar mixed; an egg shell full of tar forced down the throat, followed by a second, if the first fails; a table spoonful of volatile spirit of ammonia, diluted with

* Besides his own experience, the writer has drawn from the N. E. Farmer, the Albany Cultivator, the American Agriculturist, and other reliable American and English works, some of the remedies for diseases herein mentioned.

water; a wine-glass full of powder, mixed with cold lard and forced in balls into the stomach; a tea spoonful of unslaked lime dissolved in a pint of warm water, shaken and given immediately, or a pint of tolerably strong lye. The proper mode of giving the above remedies, is for a person to hold the horn and cartilege of the nose, while another seizes and draws out the tongue as far as possible, when the medicine is thrust below the root of the tongue. If liquid, it must be inserted by the use of a bottle. The *probang* is used when the former remedies are ineffectual. This consists of a tarred rope, or a flexible whip-stalk three-fourths of an inch diameter, with a swab or bulbous end. Two persons holding the head of the animal so as to keep the mouth in a line with the throat, while a third forces it into the stomach, when the gas finds a passsage out. A stiff leather tube with a lead nozzle pierced with holes, is best for insertion, through which the gas will readily escape. Some one of the above purgatives should be given after the bloat has subsided, and careful feeding for some days must be observed. Light gruels are best for allaying inflammation, and restoring the tone of the stomach. When no other means are available, the paunch may be tapped with a sharp pen-knife, plunging it 1½ inches forward of the hip bone towards the last rib in the left side. If the hole fills up, put in a large goose-quill tube, which to prevent slipping into the wound, may remain attached to the feather, and the air can escape through a large hole in the upper end. *Prevention* is vastly better than cure, and may be always attained, by not allowing hungry cattle to fill themselves with clover, roots, apples, &c. When first put upon such feed, it should be when the dew and rain is off, and their stomachs are already partially filled; and they should then be withdrawn before they have gorged themselves.

Choking is frequently relieved by some of the following expedients. The use of the probang or whip-stock, mentioned under the head of *remedies for Hoven*, by which the root is forced into the stomach. A soft root may be crushed so as to allow of swallowing, by holding a smooth block against it, and striking with a mallet on the opposite side. If within arms length, the root may be removed by hand. It is said this can be done by tieing up the fore-leg with a small cord close to the body, and giving the animal a sudden start with a whip; or by pulling the fore-leg out forward; or by pouring down the throat a pint bottle full of soft soap, mixed with sufficient hot water to make it run freely. *Prevention*

consists in cutting the roots; not feeding them when the animals are very hungry; and not disturbing them while eating.

Inflammation of the stomach is frequently produced by a sudden change from dry to green food, and some other causes. Epsom salts, castor oil, sulphur and carbonate of soda, in sufficient quantity to purge freely, are good remedies. It may be prevented by changing the food gradually.

Mange or scab.—This is denoted by the animal rubbing the hair off about the eyes and other parts, the skin is scaly or scabby, sometimes appearing like a large seed-wart. *Remedy.*—Rub the spots with sulphur and lard, after scraping and washing with soap. When the skin is cracked, take sulphur, 1 lb; turpentine, 1-4 lb; unguentum, (or mercurial ointment,) 2 ounces; linseed oil, 1 pint. Melt the turpentine and warm the oil, and when partly cooled, stir in the sulphur, and when cold add the unguentum, mixing all well. Rub this thoroughly with the hand on the parts affected. We have no doubt this, like scab in sheep and itch in the human species, will be found, on close investigation, to be caused by minute insects located in the skin. Salt and water ought in that case to be a good remedy.

Hollow horn, or horn ail, is not unfrequently *hollow stomach*, and very often follows stinted fare, hard usage, and exposure to cold. We have noticed this as most prevalent among oxen that have done a severe winter's work. *Symptoms.*—Bloody urine; swollen udder; shaking the head; eyes and head swollen; standing with the head against a fence or barn; eyes dull and sunken, and horns cold. *Remedies.*—1. Bleed and physic, shelter and feed properly. 2. Take a half pint good vinegar, two table spoonsful of salt, one tea spoonful of pepper and mix and pour into each ear, holding the head on one side for two minutes. 3. Bore with a large gimblet on the under side of the horn, three or four inches from the head, and if hollow, bore nearer the head and let out all the matter, and syringe two or three times a day with salt and water, or soap suds, or salt and vinegar. 4. Spirits of turpentine rubbed in around the base of the horns, will arrest the disease in its incipient stages. 5. Pour a spoonfull boiling hot brimstone into the cavity between the horns. 6. Pour a tea kettle of boiling water on the horns, holding so as to prevent injury to the other parts. 7. Soot and pepper given internally are good.

Jaundice or yellows.—This is owing to gall stones or calculi, which occasionally accumulate in large numbers,

and is sometimes owing to increased or altered quality of the bile. It is manifest by the yellowness of the eye and skin, and high color of the urine, and poor appetite. *Remedy.*—Bleeding and purgatives with Epsom salts; or, if taken in season, 2 ounces ground mustard, mixed with a liquid, and given twice a day. Green food is a good preventive.

MAD ITCH.—This disease exists in some of the western states, and shows itself by jerking of the head and itching around the nose and base of the horns. They will lick their sides and backs, and jerk and hiccup till they fill themselves with wind; afterwards they froth at the mouth, and in 24 hours, die raving mad. *Remedy.*—Give as much soot and salt as the animal will eat; soon after give 3-4 or 1 lb. brimstone or sulphur, and 8 hours, after as many salts.

BLOODY MURRAIN, OR RED WATER.—This disease first shows itself in a cough, then heaving of the flanks, with bloody, black and fœtid fæces, tenderness over the loins, and coldness of the horns. Tumors and biles sometimes appear. The animal holds down the head, moans, and is restless and staggers when walking.

We have lost several animals by this fatal disease, and are not aware of having cured any when severely attacked. In repeated instances we have seen large flukes taken out of the liver, strongly resembling the common leech, which abounds in many of our swampy lands. It is certain that on new, low swamps and clay lands, cattle are most liable to it; and when they have been subject to repeated attacks in such localities, clearing and draining have checked it. Youatt attributes it to certain kinds of forage which is peculiar to the above situations. We are rather inclined to attribute it to exposure, to excessive dampness, and especially to miasma; for although the brute creation are perhaps less sensitive to these influences than man, yet, as they are governed by the same unvarying laws of nature, when subjected to conditions totally unsuited to their economy, they must suffer equally in kind, though probably not in degree, with the more refined human frame. But it is evident the disease, its causes, and remedies, are as yet imperfectly understood. *Remedies.*—However intelligent men may differ as to its causes, all agree that the animal should first be bled and then thoroughly purged. In obstinate cases, this last is a difficult matter. We have given repeated doses of powerful cathartics without producing any effect; and whenever the medicine is inoperative, death speedily follows. Large doses of common salt, or Epsom salts dissolved in wa-

ter, are good purgatives, and if the animal neglects drinking after taking them, he should be drenched with copious draughts of water. These should be repeated every few hours if ineffectual. Injections are sometimes useful when medicine fails to act. These may be made of soap and water; or take 2 or 3 gills of oats boiled, 3 drachms salt petre, 1½ oz. linseed oil, mix and use them when warm. The opening of the bowels may be followed with a pint of linseed oil, as an additional and gentle laxative. When the animal begins to recover, gentle astringents and tonics may be given.

Preventives.—We have more confidence in preventives than in remedies. Good keep, shelter, dryness, and good health, will generally prevent attack. The cattle should at all times be supplied with two or three troughs under cover, and on the sides and bottoms of which, tar should be plentifully spread. Let equal portions of salt and slacked lime be in one; salt and wood ashes in another; and salt and brimstone in a third. Many farmers have entirely avoided this disease while using one or more of these, when they annually lost many by it previously.

Hoof ail is indicated by lameness, fever, and a soft swelling just above the hoof. *Remedies.*—Carefully wash the foot in warm soap suds, and while still damp, apply between the claws on the affected part, from one to three grains of corrosive sublimate. If it does not fully adhere, it must be mixed with hogs lard, but it should be so applied as to be out of the reach of the animal's tongue, as it is a powerful poison, and the extreme irritability of the feet will induce him to lick them. The claw is efficiently cleansed by drawing a cord briskly through it, when either of the above applications, or blue vitriol put on two or three times a day; or spirits turpentine, will effect a cure. It is sometimes cured by putting the animal in the stantials and applying a sharp chisel three fourths of an inch from the toe, and striking it with a mallet till it is cut off. If it does not bleed freely, cut off shavings till it does. If the animal is refractory, let a person hold up the opposite foot. Keep them in the stable two or three days, and out of the mud for a week.

Loss of cud is loss of appetite, prostration, and general ill health. *Remedies.*—Give a warm bran mash, with good hay, and warm water with salt. An aloe tincture, made with brandy and ginger, is good. Afterwards, good, dry, nourishing food; and bitter infusions, chamomile flowers, hoarhound, oak bark, &c., in beer.

SCOURS, OR DIARRHŒA.—A common remedy is to boil the bark of white oak, white pine and beech, and give a strong infusion in bran. If they refuse to eat it, pour it down. The oak is astringent, and the pine and beech is soothing and healing.

WARBLES are grubs, the egg of which is deposited in the back of cattle by the gad fly, (*Œstrus bovis.*) They are discernable by a protuberance or swelling on the back. They may be pressed out by the thumb and finger; or burnt out by plunging a hot wire in them; or a few applications of strong brine will remove them.

WOUNDS in cattle are readily healed when the animal's blood is in good order, by applying a salve made of 1 oz. green copperas, 2 oz. white vitriol, 2 oz. salt, 2 oz. linseed oil, 8 oz. W. I. molasses. Boil over a slow fire 15 minutes in a pint of urine, and when almost cold, add 1 oz. oil of vitriol, and 4 oz. spirits turpentine. Apply it with a feather to the wound, and cure soon follows.

MILK, OR PUERPERAL FEVER, is a common disease with cows in high condition at the time of calving. It may, in almost every case be avoided, by keeping them in moderate feed and flesh. *Remedy.*—Bleed freely, say 6 to 10 quarts, according to the circulation of the blood; then give 1 to 1½ lbs. of epsom salts, according to the size of the beast, to be repeated in half lb. doses every six hours, till she purges freely. Injections should always be given when purgatives are tardy in their operation.

CAKED BAG may be removed by simmering the bark of the root of bitter-sweet in lard, till it becomes very yellow. When cool, apply it to the swollen udder once in 8 or 10 hours; or wash it several times a day in cold water. A pint of horse-radish fed once a day, cut up with potatoes or meal, is useful for the same purpose. It is also a tonic, helps the appetite, and is good for oxen subject to heat.

GARGET is a more intense degree of inflammation than exists in caked bag, and sore, swollen teats, and shows itself in hard bunches on the udder. The cow should be bled and take a large dose of physic; then wash the udder as in caked bag. Repeated doses of sulphur is a good remedy. Garget or scoke root given of the size of a large finger, grated and fed in their food, is a general application with farmers. The garget plant grows from three to six feet high, with a purple stalk, and strings of berries hanging down between the branches.

Sore teats may be healed by rubbing with goose oil, cream, new milk; or the applications for caked bag. The bag and teats should be well cleansed with warm soft water, if to be followed by any ointment. The following application is recommended by Youatt. One ounce of yellow wax and three of lard; melt together, and when cooling, rub in one quarter oz. of sugar of lead, and a drachm of alum finely powdered.

Warts are of two kinds; the first, on the outer skin, may be removed by rubbing with camphorated olive oil. The others penetrate into the flesh, and may be removed by a ligature of fine twine, or silk, or india rubber drawn into a string, and tied tightly around the wart, which falls off in a few days. Nitrate of silver, (lunar caustic,) applied to the wart, will remove it, but it produces a sore; or, apply a strong wash of alum; rub with the juice of milk weed; poultice with grated carrot; or cut off the wart with sharp scissors when the cow is dry. It will bleed little and soon heal.

[*Devon Cattle.*—In the 6th line, page 278, for *narrow*, (a typographical error,) read *wide hips.*]

CHAPTER XVI.

THE DAIRY.

COWS FOR THE DAIRY.—From what has been said on the various characteristics of the different breeds of cattle, it must be evident, that no very definite criteria of excellence can be given, for all good dairy cows. But there are certain points in a good milker, that can hardly be mistaken. She should be descended from the best milking stock; her head should be small or of medium size, muzzle fine and nostrils flexible and expanded; face long, slender and dishing; cheeks thin; eyes full, mild and prominent; horns delicate and waxy, and they may be either branching, lopped, crumpled, or hornless; long, thin, lively ear, and the inside of an orange color; neck thin and small at its junction with the head; deep chest, but not too heavy before; back level and broad; well ribbed; belly large; low flank; wide thighs, but thin; short legs, and standing well apart; large milking veins; loose, capacious udder, coming well out behind; good teats; loose, mellow skin, of a deep yellow; and a fine, thick coat of glossy hair; and she must be of a good disposition, and free from tricks. Yet with all the skill of a well practised taste in the selection of animals, the dairyman will frequently find his theories and results at sad variance. One may sometimes select a fine animal, with every appearance of good milking qualities, which is but a medium cow at the pail; and another, that hardly seems worthy of notice, and which sets at defiance many established milking points and all preconceived notions of symmetry, may yet prove a good milker. A cow that runs to flesh while in milk, is generally an indifferent animal for the dairy. Perfection in a cow, consists in converting all she eats into milk while yielding it, and when dry, in turning all she consumes into valuable meat.

MANAGEMENT OF DAIRY COWS.—A cow may have her first calf when between 2 and 3 years of age, according to

her size and developments. After calving, she should be stinted in her food for two or three days, and not fed freely for a week. Avoid fat in a breeding cow. Too high feeding is the cause of milk-fever, caked bag, garget, and a host of evils; and too poor feed is almost equally objectionable. The average time of a cow with young, is from 40 to 41 weeks; but they sometimes go only 34, and occasionally overrun 44. A dry, unoccupied stall or yard is best for her to calve in; and if there is any serious delay or difficulty in the operation, she may be assisted by placing the fœtus in the right position, and gently pulling it with every throe of the dam. After the calf has drawn all he wants at morning and evening, the bag should be thoroughly and quickly emptied of a'l the milk. If strong and vigorous, the calf is the best doctor for garget or caked bag. He may be allowed to suck the cow or not, at the option of the owner; there are reasons for and against the practice, as will be seen under the head of raising calves, and each person must determine in his own case, on which side the balance lies.

MILKING.—This is an important operation, and on its proper performance depends much of the success of the dairyman. A cow regularly, gently, yet quickly and thoroughly milked, will give much more than if neglected. If a herd of cows be separated into two divisions, each yielding the same quantity of milk, and one is given to a good milker, and the other to a shiftless or lazy one, the latter will speedily reduce his milk much below the quantity obtained by the former; and if the milkers then exchange cows, they will be found to change quantity too, those before affording the least, soon giving the most. An indifferent milker ought never to be tolerated in a herd; good ones are cheaper at double the price. It is best to milk at intervals of about 12 hours; which may be done when pastures are convenient, or cows are soiled or fed in the yard. But as this is not often the case, they should be milked early in the morning and turned into pasture, to fill themselves before the sun is oppressive; and if they are to be kept up at night, let them browse in the pasture as long as possible before they are brought to the yard.

MILK

Is produced from the females of all the warm-blooded animals, which are ennumerated among the mammaliæ. The milk of several animals is employed for domestic purposes, among

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different nations. That of the camel is used by the Arabs, the milk of the ass by the Spaniards, the Maltese, and the inhabitants of the Levant; that of the mare by the Cossacks, the Kirgheez, and other Tartars; and that of the goat, the ewe and the cow, by most of the ancient, and with few exceptions, by every modern European nation. Within the last century however, the use of all excepting cow's milk, has been almost entirely discarded among the most highly civilized people. If we except some few Welsh and Swiss, or other emigrants, who resort to the goat and ewe for their dairy materials, for the first few years of their residence here, the cow is the only animal which is employed in America for producing milk. For this, she is pre-eminently fitted, and the modern improvement of this invaluable animal, has carried her product of milk almost as far as can be reasonably looked for from a given amount of food; and although this is of about the average richness of the goat and ewe, and before that of the ass, the quantity she yields is frequently as 80 to 1 in favor of the cow over the first two competitors. As a milk-giving animal, the cow is the best fitted for the purposes of civilized man, and she is made to contribute, not only to his health, his comfort and his economy, but to many of his choicest luxuries. Milk contains every element of nutrition necessary to animal existence; and man can subsist with unimpaired health and strength, if limited to this food alone.

THE CONSTITUENTS OF MILK are butter, which varies from 2 to 6 per cent.; casein or cheese, usually 4 to 5, but some times varying from 3 to 15 per cent.; (the last excessive quantity, yielded only by the first milk after calving;) milk-sugar, 4 to 6; salts or saline matter, 0·2 to 0·6; and water, 80 to 89.

There is much diversity in the product and quality of milk from cows of the same breed, the same food, and other circumstances and conditions apparently equal. Thus of a herd of 22, chiefly Ayrshire, one gave 84 quarts in one week, which afforded 3½ lbs. of butter; two others in the same time gave 86, yielding 5½ lbs.; and a fourth gave 88 quarts, making 7 lbs. The amount of butter however, which a given quantity of milk will produce, is not the only criterion of the value of the milk, except for this purpose alone. Some cows will yield more butter, others will produce more cheese; while for consumption, another may partially compensate, in the increased quantity of milk-sugar, and the saline matters, for a deficiency of both the other ingredients. But for dairy

purposes, butter and cheese, are the only measure of the value of milk; and a cow is esteemed good or indifferent, as she gives one or the other in the greatest abundance.

CIRCUMSTANCES WHICH MODIFY THE QUANTITY AND CHARACTER OF MILK.—Besides the accidental variation in the quantity and quality of milk in different animals before adverted to, there are many reliable causes which influence both. Of these, parentage has a most decided and uniform influence, frequently modified, however, in the particular individual, by some personal and controlling causes. But a cow whose maternal ancestry on both sides are choice milkers, is almost certain to resemble them. Food influences the quantity rather than the quality. Boussingault tried numerous experiments, with cows fed on various kinds of food, and found the difference hardly appreciable in the quality of milk. Its true benefit is to be looked for, in the increased quantity, through which the valuable ingredients are distributed in nearly the same proportion, as when the product is materially lessened. By quality we mean to be understood, the amount of the ingredients, valuable for nutrition only; for it is certain, that there is a rich aromatic flavor, not only in milk, but in butter and cheese, which is afforded in various articles of food, and especially by the fresh green herbage which abounds in the pastures from spring to autumn. Activity or rest has a great effect on both quantity and quality. The less action and the more quiet and rest, the greater the amount of milk and butter. But exercise is absolutely essential to the production of cheese. Butter may be made from cows confined in a stable, but cheese can only be profitably made by animals at pasture. It is supposed by physiologists, that the exercise in gathering their food, rather than any peculiarity in its character, is necessary to convert the nitrogenized tissues, into the nitrogenized principle of caseum or cheese. The time from calving, has also its effect. The first milk drawn from a cow after calving, has been found to yield over 15 per cent. of casein, while in its ordinary state it gives only 3 to 5½. As the quantity of milk diminishes in a farrow cow, the quality improves within certain limits. Pregnancy affects the quality injuriously, and especially towards its latter stages; and a cow that is predisposed to giving milk, should be dried off a few weeks before its expiration, as it is then unfit for use. Fat cows give poorer milk than such as are moderately lean; and young animals do not come up to the maximum of their quality, till after their third or fourth

calving. The milk first drawn from the udder, will yield only an eighth and sometimes even a much less proportion of cream, than the strippings; and the milk which is drawn three times a day, is greatly inferior to such as is taken but once, though the latter is less abundant. Excitement, or fretfulness; change of locality, or to a different herd with new companions; separation from her calf; periodical heat; annoyance from flies, or worry from dogs; exposure to storms, severe cold, or an oppressive sun; and many similar causes, diminish the quantity of milk and butter; but some of these may reasonably be expected to increase the proportion of its casein.

Dr. Playfair found that the quantity of butter in the evening milk, after the cow had been at pasture all day, was 3.7 per cent., while the casein was 5.4; after lying quietly all night, the milk from the same cow on the following morning, contained 5.6. per cent. of butter, and only 3.9. of casein. In stabling the cow, the butter was invariably in greater proportion than when allowed to ramble in the pasture; and the casein with a single exception, was equally diminished.

Cream—If milk be immediately set away in shallow vessels, after being taken from the cow, the cream rises to the surface, and carries with it most of the butter contained in the milk, and along with it much of its casein. Hence the great nutritive properties of butter-milk, which retains the casein in very large proportions, much of it being rejected by the butter in its separation from the cream. A temperature below 34°, will prevent the cream from rising in any considerable quantity, and preserve the milk unaltered for some weeks. Coagulating the milk from any cause, will equally prevent the separation of the cream. The elevation of temperature within certain limits, hastens the separation. Thus, at 50°, the cream will mostly have risen in 36 hours; at 55°, in 24; at 68°, in 18 or 20, and at 77°, in 10 or 12 hours. Heating the milk near the boiling point, and then setting it away and allowing it to remain undisturbed, will soon cause the cream to rise. In the celebrated Orange dairy, near Baltimore, Md., this system was practised, by which, not only most of the cream was secured for butter, but in consequence of its rapid separation, the skimmed milk was sent to market apparently fresh; and the scalding imparted to it an agreeable flavor and apparent richness, which it did not really possess. The celebrated clouted cream of Devonshire, England, and the butter made from it, contained an unusual quantity of

casein, the consequence of heating the milk. "It is prepared by straining the warm milk into large shallow pans into which a little water has previously been put, allowing these to stand from 6 to 12 hours, and then carefully heating them over a slow fire, or on a hot plate, till the milk approaches the boiling point. The milk, however, must not actually boil, nor must the skin of the cream be broken. The dishes are now removed into the dairy, and allowed to cool. In summer the cream should be churned on the following day; in winter it may stand over two days. The quantity of cream obtained is said o be one-fourth greater by this method, and the milk which is eft is proportionably poor."—(*Johnston.*)

BUTTER.

Sour Cream.—"Cream for the purpose of churning is usually allowed to become sour. It ought to be at least one day old, but may with advantage be kept several days in cool weather; if it be previously well freed from milk and be frequently stirred to keep it from curdling. This sour cream is put into the churn and worked in the usual way till the butter separates. This is collected into lumps, well beat and squeezed free from the milk, and in some dairies is washed with pure cold water as long as the water is rendered milky. In other localities the butter is not washed, but, after being well beat, is carefully freed from the remaining milk by repeated squeezings and dryings with a clean cloth. Both methods, no doubt, have their advantages. In the same circumstances the washed butter may be more easily preserved in the fresh state, while the unwashed butter will probably possess a higher flavor.

Sweet cream may be put into the churn and the butter be obtained, but in most cases it requires more labor and longer time, without, in the opinion of good judges, affording in general a finer quality of butter. In all cases the cream becomes sour during the agitation and before the butter begins distinctly to form.

Clouted cream.—The churning of the clouted cream of this and other countries forms an exception to the general rule just stated, that more time is required in the churning of sweet creams. Clouted cream may be churned in the morning after it is made, that is, within 24 hours of the time when the milk was taken from the cow; and from such cream it is well known that the butter separates with very great ease. But in this case the heating of the cream has already

disposed the oily matter to cohere, an incipient running together of the globules has probably taken place before the cream is removed from the milk, and hence the comparative ease with which the churning is effected. There is something peculiar in butter prepared in this way, as it is known in other countries by the name of Bohemian butter. It is said to be very agreeable in flavor, but it must contain more cheesy matter than the butter from ordinary cream.

Churning the whole milk is a much more laborious method, from the difficulty of keeping in motion such large quantities of fluid. It has the advantage, however, of giving a larger quantity of butter. At Rennes, in Brittany, the milk of the previous evening is poured *into the churn* along with the warm morning's milk, and the mixture is allowed to stand for some hours, when the whole is churned. In this way it is said that a larger quantity of butter is obtained, and of a more delicate flavor. In the neighborhood of Glasgow, according to Mr. Ayton, the milk is allowed to stand six, twelve or twenty-four hours in the dairy, till the whole has cooled, and the cream has risen to the surface. Two or three milkings, still sweet, are then poured, together with their cream, into a large vessel, and are left undisturbed till the whole has become quite sour, and is completely coagulated. The proper sourness is indicated by the formation of a stiff *brat* upon the surface *which has become uneven.* Great care must be taken to keep the brat and curd unbroken until the milk is about to be churned, for if any of the whey be separated the air gains admission to it and to the curd, and fermentation is induced. By this fermentation the quality of the butter may or may not be affected, but that of the butter-milk is almost sure to be injured. In Holland the practice is a little different. The cream is not allowed to rise to the surface at all, but the milk is stirred two or three times a day, till it gets sour, and so thick that a wooden spoon will stand in it. It is then put into the churn, and the working or the separation of the butter is assisted by the addition of a quantity of cold water. By churning the sour milk in one or other of these ways, the butter is said to be 'rich, sound, and well-flavored.' If it be greater in quantity it is, according to Sprengel, because the fatty matter carries with it from the milk a larger quantity of casein than it does in most cases from the cream alone.

Sourness of the cream.—For the production of the best butter it is necessary that the cream should be sufficiently sour before it is put into the churn. Butter made from sweet

cream (not clouted,) is neither good in quality nor large in quantity, and longer time is required in churning. It is an unprofitable method.

Quickness in churning.—The more quickly milk or cream is churned, the paler, the softer, and the less rich the butter. Cream, according to Mr. Ayton, may be safely churned in an hour and a half, while milk ought to obtain from two to three hours. The churning ought always to be regular, slower in warm weather that the butter may not be soft and white, and quicker in winter that the proper temperature may be kept up. A barrel-churn, lately introduced into this country, being placed in a trough of water of the proper temperature, readily imparts the degree of heat required by the milk or cream without the necessity of adding warm water to the milk, *and churns the whole in ten or twelve minutes.* It is said also to give a larger weight of butter from the same quantity of milk. If the quality be really as good by this quick churning, the alleged inferiority in the quality of butter churned quickly in the common churn can not be due to the mere rapidity of churning alone.

Over-churning.–When the process of churning is continued after the full separation of the butter, it loses its fine yellowish, waxy appearance, and becomes soft and light colored. The weight of the butter, however, is considerably increased ; and hence in Lancashire over-churning is frequently practised in the manufacture of fresh butter for immediate sale.

Temperature of the milk or cream.—Much also depends upon the temperature of the milk or cream when the churning is commenced. Cream when put into the churn should never be warmer than 55° Farenheit. It rises during the churning from 4° to 10° F. above its original temperature. When the whole milk is churned, the temperature should be raised to 65° F., which is best done by pouring in hot water into the churn *while the milk is kept in motion.* In winter, either of these temperatures may be easily attained. In cold weather it is often necessary to add hot water to the cream to raise it even to 55°. But in summer, and especially in hot weather, it is difficult, even in cool and well ordered dairies, (without the use of ice,) to keep the cream down to this comparatively low temperature. Hence if the cream be then churned, a second rate butter, at best, is all that can be obtained.

The alleged advantages of churning the entire milk may be thus stated. The proper temperature can be readily obtained both in winter and summer. A hundred gallons of entire

milk will give in summer five per cent. more butter than the cream from the same quantity of milk will give. Butter of the best quality can be obtained without difficulty both in winter and summer. No special attention to circumstances or change of method is at any time required. The churning in winter and summer is alike simple and easy. The butter is not only of the best quality while fresh, but is also best for long keeping, when properly cured or salted.

Cleanliness is peculiarly necessary to the manufacture of good butter. Cream is remarkable for the rapidity with which it absorbs and becomes tainted by any unpleasant odors. It is very necessary that the air of the dairy should sweet, that it should be often renewed, and that it should be open in no direction from which bad odors can come." (*Johnston and other authorities.*)

The statement of J. T. Lansing, who received the first premi m for butter from the New-York State Agricultural Society, is as follows :

1. The number of cows kept is ten.

2. Keep them stabled through the inclement season ; feed them from three to four times per day with good hay or green stalks ; when near coming in, add some oats, barley, or corn cracked. In summer, good pasture, with living water accessible at all times, and plenty of salt.

3. Treatment of milk and cream before churning.—Strain the milk in tin pans ; place them in a cool cellar for the cream to rise. When sufficiently risen, separate the cream from the milk ; put in stone jars, well prepared before churning.

4. The mode of churning in summer.—Rinse the churn with cold water ; then turn in the cream, and add to each jar of cream put in the churn, full one-fourth of the same quantity of cold water. The churn used is a patent one, moved by hand with a crank, having paddles attached, and so constructed as to warm the milk, if too cold, with hot water, without mixing them together. The milk and cream receive the same treatment in winter as in summer ; and in churning, use hot instead of cold water, if necessary.

5. The method of freeing the butter from the milk, is to wash the butter with cold water till it shows no color of the milk, by the use of a ladle.

6. Salting the butter.—Use the best kind of Liverpool sack salt ; the quantity varies according to the state in which the butter is taken from the churn ; if soft, more, if hard,

less, always taking the taste for the surest guide. Add no saltpetre, nor other substances.

7. The best time for churning is the morning, in hot weather, and to keep the butter cool till put down.

8. The best mode of preserving butter in and through the summer and winter, is as follows:—The vessel is a stone jar, clean and sweet. The mode of putting it down is to put in a churning of butter, and put on strong brine; let it remain on until the next churning is ready to put down, and so on till the jar is filled; then cover it over with fine salt, the same to remain on till used.

Mr. McWilliams of Orange county, the celebrity of whose butter is unsurpassed, thus details his method of butter-making:

"Our practice is not to churn the milk until it becomes thick or loppered, the milk and cream is then churned together. The temperature of the milk is about 50 degrees. In warm weather about a quart of cold water is put in each pan before the milk is strained, so as to keep it sweet as long as possible. The cellar-floor is brick. This in warm weather is daily cleansed with cold water. A drain from the cellar carries off the water thus applied. The churn is filled about half full with milk, with the addition of two pails of cold water before starting the churn. In cold weather the same quantity of warm water is applied. When the churning is finished, which usually occupies about two hours of time, there are then two more pails of cold water applied to raise the butter and cool it. The butter is then taken out of the churn and put in a large tray, this is immediately filled with cold water and the butter carefully washed; after which the water is thrown off. The butter now undergoes the process of salting, it is then placed in a cool situation where it stands about an hour, and worked carefully over. This finished it is placed in the same situation as before, where it stands three or four hours, and is again worked over; again replaced for five or six hours, when it is worked over for the third time. It is now replaced, where it stands till the next morning and worked over for the fourth time. A small quantity of nitre is then put in the butter. Thus finished it is placed in firkins holding about 85 lbs. Previous to packing, the firkin is scalded with hot water, rinsed and cooled with cold water, then rubbed all around with fine salt; this prevents the butter from adhering to the sides of the firkin. When the firkin is full, a linen cloth is placed over the top of

the butter; on this cloth a covering of salt is put one inch deep, and cold water enough added to it to form a brine. It then stands till it is to be sent to market when the cloth and salt are removed, the firkin turned down, the top of the butter in the keg washed with cold water and the pickle drained off. The firkin is now neatly headed up and sent to market."

The salt added to the butter should be from 1-24th to 1-28th of its weight, or about $\frac{2}{3}$ of an ounce to a pound, and this must be of the best quality. All the butter-milk must be thoroughly extracted by repeated washings; and when completed the butter should be immediately packed and not a particle of air allowed to come in contact with it till opened for the table.

CHEESE.

THE CIRCUMSTANCES AFFECTING THE QUALITY OF CHEESE. "All cheese consists essentially of the curd mixed with a certain portion of the fatty matter and of the sugar of milk. But differences in the quality of the milk, in the proportion in which the several constituents of milk are mixed together, or in the general mode of dairy management, give rise to varieties of cheese almost without number. Nearly every dairy district produces one or more qualities of cheese peculiar to itself.

Natural differences in the milk.—It is obvious that whatever gives rise to natural differences in the quality of the milk must affect also that of the cheese prepared from it. If the milk be poor in butter, so must the cheese be. If the pasture be such as to give a milk rich in cream, the cheese will partake of the same quality. If the herbage or other food affect the taste of the milk or cream, it will also modify the flavor of the cheese.

Milk of different animals.—So the milk of different animals will give cheese of unlike qualities. The ewe-milk cheeses of Tuscany, Naples, and Languedoc, and those of goat's milk made on Mont Dor and elsewhere, are celebrated for qualities which are not possessed by cheeses prepared from cow's milk in a similar way. Buffalo milk also gives a cheese of peculiar qualities, which is manufactured in some parts of the Neapolitan territory. Other kinds of cheese again are made from mixtures of the milk of different animals. Thus the strong tasted cheese of Lecca and the celebrated Roquefort cheese are prepared from mixtures of goat with

ewe-milk, and the cheese of Mont Cenis from both of these mixed with the milk of the cow.

Creamed or uncreamed milk.—Still further differences are produced according to the proportion of cream which is left in or is added to the milk. Thus if cream only be employed, we have the rich *cream-cheese* which must be eaten in a comparatively recent state. Or, if the cream of the previous night's milking be added to the new milk of the morning, we may have such cheese as the *Stilton* of England, or the small, soft, and rich *Brie* cheeses, so much esteemed in France. If the entire milk only be used, we have such cheeses as the *Cheshire*, the *Double Gloucester*, the *Cheddar*, the *Wiltshire*, and the *Dunlop* cheeses of Britain, the Kinnegad cheese, I believe, of Ireland, and the Gouda and Edam cheeses of Holland. Even here, however, it makes a difference whether the warm milk from the cow is curdled alone, as at Gouda and Edam, or whether it is mixed with the milk of the evening before, as is generally done in Cheshire and Ayrshire. Many persons are of opinion that cream, which has once been separated, can never be so well mixed again with the milk, that a portion of the fatty matter shall not flow out with the whey and render the cheese less rich. If, again, the cream of the evening's milk be removed, and the skimmed milk added to the new milk of the next morning, such cheeses as the *Single Gloucester* are obtained. If the cream be taken once from *all* the milk, the better kinds of skimmed-milk cheese, such as the Dutch cheese of Leyden, are prepared; while if the milk be twice skimmed, we have the poorer cheeses of Friesland and Groningen. If skimmed for three or four days in succession, we get the hard and horny cheeses of Essex and Sussex, which often require the axe to break them up.

Butter-milk cheese.—But poor or butterless cheese will also differ in quality according to the state of the milk from which it is extracted. If the new milk be allowed to stand to throw up its cream, and this be then removed in the usual way, the ordinary skimmed-milk cheese will be obtained by adding rennet to the milk. But if, instead of skimming, we allow the milk to stand till it begins to sour, and then remove the butter by churning the whole, we obtain the milk in a sour state (*butter-milk.*) From this milk the curd separates naturally by gentle heating. But being thus prepared from sour milk and without the use of rennet, butter-milk cheese differs more or less in quality from that which is made from sweet

skimmed-milk. The acid in the butter-milk, especially after it has stood a day or two, is capable of coagulating new milk also, and thus, by mixing more or less sweet milk with the butter-milk before it is warmed, several other qualities of mixed butter and sweet milk cheese may readily be manufactured.

Whey-cheese.—The whey which separates from the curd, and especially the white whey, which is pressed out towards the last, contains a portion of curd, and not unfrequently a considerable quantity of butter also. When the whey is heated, the curd and butter rise to the surface, and are readily skimmed off. This curd alone will often yield a cheese of excellent quality, and so rich in butter, that a very good imitation of Stilton cheese may sometimes be made with alternate layers of new milk-curd and this curd of whey.

Mixtures of vegetable substances with the milk.—New varieties of cheese are formed by mixing vegetable substances with the curd. A green decoction of two parts of sage leaves, one of marigold, and a little parsley, gives its color to the *green cheese* of Wiltshire; some even mix up the entire leaves with the curd. The celebrated Schabzieger cheese of Switzerland is made by crushing the skim-milk cheese after it is several months old to fine powder in a mill, mixing it then with one-tenth of its weight of fine salt, and one-twentieth of the powdered leaves of the mellilot trefoil, (*trifolium melilotus cerulea*,) and afterwards with oil or butter, working the whole into a paste, which is pressed and carefully dried.

Potato cheeses, as they are called, are made in various ways. One pound of sour milk is mixed with five pounds of boiled potatoes and a little salt, and the whole is beat into a pulp, which, after standing five or six days, is worked up again, and then dried in the usual way. Others mix three parts of dried boiled potatoes with two of fresh curd, or equal weights, or more curd than potato according to the quality required. Such cheeses are made in Thuringia, in Saxony, and in other parts of Germany. In Savoy, an excellent cheese is made by mixing one of the pulp of potatoes with three of ewe milk curd, and in Westphalia a potato cheese is made with skimmed milk.

Preparation of rennet.—Rennet is prepared from the salted stomach or intestines of the suckling calf, the unweaned lamb, the young kid, or the young pig. In general, however, the stomach of the calf is preferred, and there are various

ways of curing and preserving it. The stomach of the newly killed animal contains a quantity of curd derived from the milk on which it has been fed. In most districts it is usual to remove by a gentle washing the curd and slimy matters which are present in the stomach, as they are supposed to impart a strong taste to the cheese. In Cheshire the curd is frequently salted separately for immediate use. In Ayrshire and Limburg, on the other hand, the curd is always left in the stomach and salted along with it. Some even give the calf a copious draught of milk shortly before it is killed, in order that the stomach may contain a larger quantity of the valuable curd.

Salting the stomach.—In the mode of salting the stomach similar differences prevail. Some merely put a few handfuls of salt into and around it, then roll it together, and hang it near the chimney to dry. Others salt it in a pickle for a few days, and then hang it up to dry (Gloucester,) while others again (Cheshire) pack several of them in layers with much salt both within and without, and preserve them in a cool place till the cheese-making season of the following year. They are then taken out, drained from the brine, spread upon a table, sprinkled with salt which is rolled in with a wooden roller, and then hung up to dry. In some foreign countries, again, the recent stomach is minced very fine, mixed with some spoonfuls of salt and bread-crumb into a paste, put into a bladder, and then dried. In Lombardy the stomach, after being salted and dried, is minced and mixed up with salt, pepper, and a little whey or water into a paste, which is preserved for use. In whatever way the stomach or intestine of the calf is prepared and preserved, the almost universal opinion seems to be, that it should be kept for 10 or 12 months before it is capable of yielding the best and strongest rennet. If newer than 12 months, the rennet is thought in Gloucestershire to make the cheese heave or swell, and become full of eyes or holes.

Making the rennet.—In making the rennet different customs also prevail. In some districts, as in Cheshire, a bit of the dried stomach is put into half a pint of lukewarm water with as much salt as will lie upon a shilling, is allowed to stand over night, and in the morning the infusion is poured into the milk. For a cheese of 60 lbs. weight, a piece of the size of half-a-crown will often be sufficient, though of some skins as much as 10 square inches are required to produce the same effect. It is perhaps more common, however, to take

the entire stomach, and to pour upon them from one to three quarts of water for each stomach, and to allow them to infuse for several days. If only one has been infused, and the rennet is intended for immediate use, the infusion requires only to be skimmed and strained. But if several be infused, or, as is the custom in Cheshire, as many as have been provided for the whole season, about two quarts of water are taken for each, and, after standing not more than two days, the infusion is poured off, and is completely saturated with salt. During the summer it is constantly skimmed, and fresh salt added from time to time. Or a strong brine may at once be poured upon the skins, and the infusion, when the skins are taken out, may be kept for a length of time. Some even recommend that the liquid rennet should not be used until it is at least two months old. When thus kept, however, it is indispensable that the water should be fully saturated with salt. In Ayrshire, and in some other counties, it is customary to cut the dried stomach into small pieces, and to put it, with a handful or two of salt and one or two quarts of water, into a jar, to allow it to stand for two or three days, afterwards to pour upon it another pint for a couple of days, to mix the two decoctions, and, when strained, to bottle the whole for future use. In this state it may be kept for many months.

In making rennet, some use pure water only, others prefer clear whey, others a decoction of leaves, such as those of the sweetbriar, the dogrose, and the bramble, or of aromatic herbs and flowers, while others again, put in lemons, cloves, mace, or brandy. These various practices are adopted for the purpose of making the rennet keep better, of lessening its unpleasant smell, of preventing any unpleasant taste it might give to the curd, or finally of directly improving the flavor of the cheese. The acidity of the lemon will, no doubt, increase also the coagulating power of any rennet to which it may be added. The rennet thus prepared is poured into the milk previously raised to the temperature of 90° or 95° F., and is intimately mixed with it. The quantity which it is necessary to add varies with the quality of the rennet, from a table-spoonful to half a pint for 30 or 40 gallons of milk. The time necessary for the complete fixing of the curd varies also from 15 minutes to an hour or even an hour and a half. The chief causes of this variation are the temperature of the milk, and the quality and quantity of the rennet employed.

Different Qualities of Cheese.—The temperature of new or entire milk, when the rennet is added, should be raised to about 95° F.; that of skimmed milk need not be quite so high. If the milk be warmer the curd is hard and tough, if colder, it is soft and difficult to obtain free from the whey. When the former happens to be the case, a portion of the first whey that separates may be taken out into another vessel, allowed to cool, and then poured in again. If it prove to have been too cold, hot milk or water may be added to it; or a vessel containing hot water may be put into it before the curdling commences; or the first portion of whey that separates may be heated and poured again upon the curd. The quality of the cheese, however, will always be more or less affected when it happens to be necessary to adopt any of these remedies. To make the best cheese, the true temperature should always be attained as nearly as possible, before the rennet is added.

Mode in which the milk is warmed.—If, as is the case in some daries, the milk be warmed in an iron pot upon the naked fire, great care must be taken that it is not singed or *fire-fanged.* A very slight inattention may cause this to be the case, and the taste of the cheese is sure to be more or less affected by it. In Cheshire the milk is put into a large tin pail, which is plunged into a boiler of hot water, and frequently stirred till it is raised to the proper temperature. In large dairy establishments, however, the safest method is to have a pot with a double bottom, consisting of one pot within another, after the manner of a glue pot; the space between the two being filled with water. The fire applied beneath thus acts only upon the water, and can never, by any ordinary neglect, do injury to the milk. It is desirable in this heating, not to raise the temperature higher than is necessary, as a great heat is apt to give an oiliness to the fatty matter of the milk.

The time during which the curd stands is also of importance. It should be broken up as soon as the milk is fully coagulated. The longer it stands after this the harder and tougher it will become.

The quality of the rennet is of much importance not only in regard to the certainty of the coagulation, but also to the flavor of the cheese. In some parts of Cheshire, as we have seen, it is usual to take a piece of the dried membrane and steep it overnight with a little salt for the ensuing morning's milk. It is thus sure to be fresh and sweet if the dried *maw*

be in good preservation. But where it is customary to steep several skins at a time, and to bottle the rennet for after-use, it is very necessary to saturate the solution completely with salt, and to season it with spices, in order that it may be preserved in a sweet and wholesome state.

The quantity of rennet added ought to be regulated as carefully as the temperature of the milk. Too much renders the curd tough; too little causes the loss of much time, and may permit a larger portion of the butter to separate itself from the curd. It is to be expected also that when rennet is used in great excess, a portion of it will remain in the curd, and will naturally affect the kind and rapidity of the changes it afterwards undergoes. Thus it is said to cause the cheese to heave or swell out from fermentation. It is probable also that it will affect the flavor which the cheese acquires by keeping. Thus it may be that the agreeable or unpleasant taste of the cheeses of certain districts or daries may be less due to the quality of the pastures or of the milk itself, than to the quantity of rennet with which it has there been customary to coagulate the milk.

The way in which the rennet is made, no less than its state of preservation and the quantity employed, may also influence the flavor or other qualities of the cheese. For instance, in the manufacture of a celebrated French cheese, that of Epoisse, the rennet is prepared as follows: Four fresh calf-skins, with the curd they contain, are well washed in water, chopped into small pieces, and digested in a mixture of 5 quarts of brandy with 15 of water, adding at the same time 2½ lbs. of salt, half an ounce of black pepper, and a quarter of an ounce each of cloves and fennel seeds. At the end of six weeks the liquor is filtered and preserved in well corked bottles, while the membrane is put into salt-water to form a new portion of rennet. For making rich cheeses, the rennet should always be filtered clear. Again, on Mont Dor, the rennet is made with white wine and vinegar. An ounce of common salt is dissolved in a mixture of half a pint of vinegar with 2½ pints of white wine, and in this solution a prepared goat's stomach or *a piece of dried pig's bladder* is steeped for a length of time. A single spoonful of this rennet is said to be sufficient for 45 or 50 quarts of milk. No doubt the acid of the vinegar and of the wine aid the coagulating power derived from the membrane.

The way in which the curd is treated.—It is usual in our best cheese districts carefully and slowly to separate the curd

from the whey, not to hasten the separation, lest a larger portion of the fatty matter should be squeezed out of the curd and the cheese should thus be rendered poorer than usual. But in some places the practice prevails of washing the curd with hot water after the whey has been partially separated from it. Thus at Gouda in Holland, after the greater part of the whey has been gradually removed, a quantity of hot water is added, and allowed to remain upon it for at least a quarter of an hour. The heat makes the cheese more solid and causes it to keep better. In Italy, again, the so-called pear-shaped *caccio-cavallo* cheeses and the round *palloni* cheeses of Gravina, in the Neapolitan territory, are made from curd, which, after being scalded with boiling whey, is cut into slices, kneaded in boiling water, worked with the hand till it is perfectly tenacious and elastic, and then made into shapes. The water in which the curd is washed, after standing 24 hours, throws up much oily matter, which is skimmed off and made into butter.

The separation of the whey is a part of the process upon which the quality of the cheese in a considerable degree depends. In Cheshire more time and attention is devoted to the perfect extraction of the whey than in almost any other district. Indeed, when it is considered that the whey contains sugar and lactic acid, which may undergo decomposition, and a quantity of rennet which may bring on fermentation, by both of which processes the flavor of the cheeses must be considerably affected, it will appear of great importance that the whey should be as completely removed from the curd as it can possibly be. To aid in effecting this a curd-mill, for chopping it fine after the whey is *strained* off, is in use in many of the large English daries, and a very ingenious, and I believe effectual, pneumatic cheese-press for sucking out the whey was lately invented. But the *way* in which the whey is separated is not a matter of indifference, and has much influence upon the quality of the cheese. Thus in Norfolk, according to Marshall, when the curd is fairly set, the dairy-maid bares her arm, plunges it into the curd, and with the help of her wooden ladle breaks up minutely and intimately mixes the curd with the whey. This she does for 10 or 15 minutes, after which the curd is allowed to subside, and the whey is drawn off. By this agitation the whey must carry off more of the butter and the cheese must be poorer. In Cheshire and Ayrshire, again, the curd is cut with a knife, but is gently used and slowly pressed till it is dry enough to

be chopped fine, and thus more of the oily matter is retained. On the same principle, in making the Stilton cheese, the curd is not cut or broken at all, but is pressed gently and with care till the whey gradually drains out. Thus the butter and the curd remain intermixed, and the rich cheese of Stilton is the result. Thus while it is of importance that all the whey should be extracted from the curd, yet the quickest way may not be the best. More time and care must be bestowed in order to effect this object, the richer the cheese we wish to obtain. The quality of the milk or of the pastures may often be blamed for the deficiencies in the richness or other qualities of cheese, which are in reality due to slight but material differences in the mode of manufacturing it. *The kind of salt* used is considered by many to have some effect upon the taste of the cheese. Thus the cheese of Gerome, in the Vosges, is supposed to derive a peculiar taste from the Lorena salt with which it is cured. In Holland, also, the efficacy of one kind of salt over another for the curing of cheese is generally acknowledged.

The mode in which the salt is applied.—In making the large Cheshire cheeses the dried curd, for a single cheese of 60 lbs., is broken down fine and divided into three equal portions. One of these is mingled with double the quantity of salt added to the others, and this is so put into the cheese-vat as to form the central part of the cheese. By this precaution the after-salting on the surface is sure to penetrate deep enough to cure effectually the less salted parts. In the counties of Gloucester and Somerset the curd is pressed without salt, and the cheese, when formed, is made to absorb the whole of the salt afterwards through its surface. This is found to answer well with the small and thin cheeses made in these counties, but were it adopted for the large cheeses of Cheshire and Dunlop, or even for the pine-apple cheeses of Wiltshire, there can be no doubt that their quality would frequently be injured. It may not be impossible to cause salt to penetrate into the very heart of a large cheese, but it cannot be easy in this way to salt the whole cheese equally, while the care and attention required must be greatly increased.

Addition of cream or butter to the curd.—Another mode of improving the quality of cheese is by the addition of cream or butter to the dried and crumbled curd. Much diligence, however, is required fully to incorporate these, so that the cheese may be uniform throughout. Still this practice gives

a peculiar character to the cheeses of certain districts. In Italy they make a cheese *after the manner of the English*, into which a considerable quantity of butter is worked ; and the *Reckem* cheese of Belgium is made by adding half an ounce of butter and the yolk of an egg to every pound of pressed curd.

Size of the chesse.—From the same milk it is obvious that cheeses of different sizes, if treated in the same way, will, at the end of a given number of months possess qualities in a considerable degree different. Hence, without supposing any inferiority, either in the milk or in the general mode of treatment, the size usually adopted for the cheeses of a particular district or dairy, may be the cause of a recognized inferiority in some quality which it is desirable that they should possess in a high degree.

The method of curing has very much influence upon the after-qualities of the cheese. The care with which they are salted, the warmth of the place in which they are kept during the first two or three weeks, the temperature and closeness of the cheese-room in which they are afterwards preserved, the frequency of turning, of cleaning from mould, and rubbing with butter ; all these circumstances exercise a remarkable influence upon the after-qualities of the cheese. Indeed, in very many instances the high reputation of a particular dairy district or dairy farm, is derived from some special attention to one or other or to all of the apparently minor points to which I have just adverted. In Tuscany, the cheeses, after being hung up for some time at a proper distance from the fire, are put to ripen in an underground, cool and damp cellar ; and the celebrated French cheeses of Roquefort are supposed to owe much of the peculiar estimation in which they are held, to the cool and uniform temperature of the subterranean caverns in which the inhabitants of the village have long been accustomed to preserve them.

Ammoniacal cheese.—The influence of the mode of curing upon the quality is shown very strikingly in the small ammoniacal cheeses of Brie, which are very much esteemed in Paris. They are soft unpressed cheeses, which are allowed to ripen in a room the temperature of which is kept between 60° and 70° Farenheit, till they begin to undergo the putrefactive fermentation and emit an ammoniacal odor. They are generally unctuous, and sometimes so small as not to weigh more than an ounce.

Inoculating Cheese.—It is said that a cheese, possessed of no very striking taste of its own, may be inoculated with any flavor we approve of, by putting into it with a scoop a small portion of the cheese which we are desirous that it should be made to resemble. Of course this can apply only to cheeses otherwise of equal richness, for we could scarcely expect to give a Gloucester the flavor of a Stilton, by merely putting into it a small portion of a rich and esteemed Stilton cheese.—(*Johnston and various other authorities.*)

The statement of H. P. & G. Allen, and D. Marvin, each of whom received premiums from the New-York State Society is as follows.

Number of cows kept, eleven. Cheese made from two milkings, in the English manner; no addition made of cream. For a cheese of 20 pounds, a piece of rennet about two inches square is soaked about twelve hours in one pint of water. As rennets differ much in quality, enough should be used to coagulate the milk *sufficiently* in about forty minutes. No salt is put *into* the cheese, nor any on the outside during the first six or eight hours it is being pressed; but a thin coat of fine Liverpool salt is kept on the outside during the remainder of the time it remains in press. The cheeses are pressed forty-eight hours under a weight of seven or eight cwt. Nothing more is required but to turn the cheeses once a day on the shelves.—(*H. P. & G. Allen.*)

The milk is strained in large tubs over night; the cream stirred in milk, and in morning strained in same tub; milk heated to natural heat; add color and rennet; curd broke fine and whey off, and broke fine in hoop with fast bottom, and put in strainer; pressed twelve hours; then taken from hoop, and salt rubbed on the surface; then put in hoop, without strainer, and pressed forty-eight hours; then put on tables, and salt rubbed on surface, and remain in salt six days, for cheese weighing thirty pounds. The hoops to have holes in the bottom; the crushings are saved, and set and churned, to grease the cheese. The above method is for making one cheese per day. As in butter-making, the utmost cleanliness is required in every part of the cheese-making premises.—(*D. Marvin.*)

CHAPTER XVII.

SHEEP.

With the exception of the dog, there is no one of the brute creation which exhibits the diversity of size, color, form, covering and general appearance which characterises the sheep, and none which occupies a wider range of climate, or subsists on a greater variety of food. In every latitude between the equator and the arctic, he ranges over sterile mountains, and through the fertile vallies. He feeds on almost every species of edible forage, the cultivated grasses, clovers, cereals and roots; he browses on aromatic and bitter herbs; he crops the leaves and bark from the stunted forest shrubs, and the pungent, resinous evergreens. In some parts of Norway and Sweden, when other resources fail, he subsists on fish or flesh during their long and rigorous winters, and if reduced to necessity, he eats his own wool. He is diminutive like the Orkney, or massive like the Teeswater. He is policerate or many horned; he has two large or small spiral horns like the Merino, or is polled or hornless like the mutton sheep. He has a long tail like our own breeds; a broad tail, like many of the eastern, or a mere button of a tail, like the fat-rumps, discernible only by the touch. His coat is sometimes long and coarse, like the Lincolnshire; short and hairy, like those of Madagascar; soft and furry, like the Angola, or fine and spiral, like the silken Saxon. Their color, either pure or fancifully mixed, varies from the white or black of our own country, to every shade of brown, dunn, buff, blue, and grey, like the spotted flocks of the Cape of Good Hope and other parts of Africa and Asia. This wide diversity is the result of long domestication, under almost every conceivable variety of condition.

Uses.—Among the antediluvians, sheep were immolated for sacrificial offerings, and their fleeces probably furnished them with clothing. Since the deluge, their flesh has with all nations, been used as a favorite food for man; and by the

rude, roving nations of the East, they are employed in carrying burthens. Their milk is generally used by the uncivilized, and to some extent, by the refined nations of Europe, not only as a beverage, but for making into cheese, butter and curds. Job refers to its use, as do Isaiah and other of the Old Testament writers. Most of the Greek and Roman writers describe its general use and manufacture. The ewe's milk scarcely differs in appearance from that of the cow, but is generally thicker, and yields a pale, yellowish butter, that is always soft, and soon becomes rancid. Culley remarks, "The cheese is exceedingly pungent, and for that reason is preferred by many, to that from the cow." In Wales, it is mixed with that of the dairy, and makes a tart, palatable cheese. We have never seen it appropriated for dairy purposes in the United States, except by a few Welsh and Highland emigrants. The sheep is frequently employed in the dairy regions of this country, at the tread-mill or horizontal wheel, to pump the water, churn the milk, or perform other light domestic work.

The dignity and importance of the shepherd's vocation have ever been conspicuous. Abel, the supposed twin-brother of the first-born of the human race, was a "keeper of sheep;" and from this it may be fairly inferred, that there is no animal, which has so long been under the immediate control of man. Abraham and his descendants, as well as most of the ancient patriarchs, were shepherds. Job had 14,000 sheep. It is said of Rachel, the favored mother of the Jewish race, "she came with her father's sheep, for she kept them." The seven daughters of the priest of Midian, "came and drew water for their father's flocks." Moses, the statesman and lawgiver, who "was learned in all the wisdom of the Egyptians, kept the flocks of Jethro, his father-in-law;" and David, the future monarch of Israel, the hero, poet, and divine, was a keeper of sheep. It was to shepherds, while "abiding in the field, keeping watch over their flocks by night," that the birth of the Savior was announced. The root of the Hebrew name for sheep, signifies fruitfulness, abundance, plenty; as indicating the blessings they were destined to confer on the human race. With the sacred writers, they were the chosen symbol of purity and the gentler virtues; they were the victims of propitiatory sacrifices; and finally they became the type of redemption to fallen man. These may not be considered accidental allusions in a book, whose every feature is full of design. Nor has the sheep been less the subject of eulogy

and attention with profane writers. Among these, Homer and Hesiod, Virgil and Theocritus, introduced them with evident delight in their pastoral themes; while their heroes and demi-gods, Hercules and Ulysses, Æneas and Numa, carefully perpetuated them throughout their regal domains. In modern times they have commanded the attention of the most enlightened nations; and their prosperity has in no instance been independent of those useful animals, wherever wool and its manufactures have been regarded as essential staples. Spain and Portugal, for more than two centuries, were the most enterprizing nations of Europe, and during that period they excelled in the production and manufacture of wool. Flanders, for a time, was before England in the perfection of the arts and the enjoyments of life, and *England then sent the little wool she raised to that country to be manufactured.* Her politic sovereigns soon found this a losing game, and offered large bounties for the importation of artists and machinery. By a systematic and thorough course of legislation, which looked to the utmost protection and augmentation of wool and woolens, she has carried their production beyond anything the world has ever seen. The small islands of Great Britain and Ireland, in addition to the support of their 26 000,000 of people, 15,000,000 of cattle, 2,250,000 horses, 18,000,000 swine, and innumerable smaller domestic animals, maintain 50,000,000 sheep, worth $300,000,000; and besides manufacturing nearly all their fleeces, annually import an equal amount from abroad. The sumptuary law for burying the dead in woolen, still occupies its place in their statute book. And beyond all question, England is the leading power of the nineteenth century, in the combination of all those qualities, which constitute national greatness, civilization and strength.

VARIETIES.

Naturalists have divided the wild sheep into four varieties. *The Musimon* (*Ovis Musimon,*) inhabiting Corsica, Sardinia and other islands of the Mediterranean, the mountainous parts of Spain and Greece and some other regions bordering upon that inland sea, have been frequently domesticated and mixed with the long cultivated breeds. *The Argali* (*O. Ammon*) ranges over the steppes or elevated plains of Central Asia, northward and eastward to the ocean. They are larger, more hardy and more untameable than the Musimon. *The Rocky Mountain Sheep* (*O. Montana,*) frequently called the big-horn by our western hunters, is found on the prairies west

of the Mississippi, and throughout the wild mountainous regions, extending through California and Oregon to the Pacific. They are larger, but in other respects resemble the Argali, of which they are probably descendants; as they could cross upon the ice, at Behring's straits, from the notheastern cost of Asia. Like the argali, when caught young they are easily tamed; but we are not aware that they have ever been bred with the domestic sheep. Before the country was overrun by the white man, they probably inhabited the region bordering on the Mississippi. Father Hennepin, a French Jesuit, who wrote nearly two hundred years ago, and who falsely claims to have first discovered that river, often speaks of meeting with goats, in his travels through what is now the territory embraced by Illinois and Wisconsin. The wild, clambering propensities of these animals, occupying the giddy heights, far beyond the reach of the traveller, and the outer coating of hair, (supplied underneath however, with a thick coating of soft wool,) gives to them much of the appearance of that animal. In summer they are generally found single; but when they descend from their isolated rocky heights in winter, they are gregarious, marching in flocks under the guidance of leaders. *The Bearded Sheep of Africa* (*O. Tragelaphus*) inhabit the mountains of Barbary and Egypt. They are covered with a soft, reddish hair, and have a mane hanging below the neck, and large locks of hair at the ancle.

THE DOMESTICATED SHEEP (*O. Aries*) embraces all the varieties of the subjugated species. Whether they have descended from any one of the wild races, is a question yet undetermined among naturalists; but however this may be, many of the varieties apparently differ less from their wild namesakes than from each other. *The Fat-rumped* and *Broad-tailed sheep* are much more extensively diffused than any other. They occupy nearly all the south-eastern part of Europe, Western and Central Asia, and Northern Africa. They are supposed to be the varieties which were propogated by the patriarchs and their descendants, the Jewish race. This is inferred from various passages in the Penteteuch, Exodus, xxix. 22; Leviticus, iii. 9; viii. 25; ix. 19, and some others, where "the fat and the rump" are spoken of in connexion with offerings, in which the fat was always an acceptible ingredient. Dr. Boothroyd renders one of the foregoing passages, "the large fat tail entire, taken clear to the rump." It is certain this variety gives indisputable evidence

of remote and continued subjugation. Their long, pendant, drowsy ears, and the highly artificial posterior developments, are characteristic of no wild or recently domesticated race.

This breed consists of numerous sub-varieties, differing in all their characteristics of size, fleece, &c., with quite as many and marked shades of distinction as the modern European varieties. In Madagascar, they are covered with hair; in the south of Africa, with coarse wool; in the Levant, and along the Mediterranean, the wool is comparatively fine; and from that of the fat-rumped sheep of Thibet, the exquisite Cashmere shawls are manufactured. Both rams and ewes are sometimes bred with horns, and sometimes without, and they exhibit a great diversity of color. Some yield a carcass of scarcely 30 lbs., while others have weighed 200 lbs. dressed. The tail or rump varies greatly, according to the purity and style of breeding; some are less than one eighth, while others exceed one third the entire dressed weight. The fat of the rump or tail is considered a great delicacy, and in hot climates resembles oil, and in colder, suet. The broad-tailed were brought into this country about 50 years since, by Commodore Barron and Judge Peters, and bred with the native flocks. They were called the Tunisian Mountain sheep. Some of them were subsequently distributed by Col. Pickering, of Massachusetts, among the farmers of Pennsylvania; and their mixed descendants were highly prized as prolific and good nursers, coming early to maturity, attaining large weights of a superior quality of carcass, and yielding a heavy fleece of excellent wool. The principal objection brought against them, was the difficulty of propogation, which always required the assistance of the shepherd. The lambs were dropped white, red, tawny, bluish or black; but all excepting the black, grew white as they approached maturity, retaining some spots of the original color on the cheeks and legs, and sometimes having the entire head tawny or black. The few which descended from those originally imported into this country, have become blended with American flocks, and are now scarcely distinguishable from them.

Native or common Sheep of the United States.—Strictly speaking, there are no sheep indigenous to North America, excepting the *Ovis Montana*, or Rocky Mountain sheep. Before the introduction, of the improved European breeds, during the present century, our sheep consisted generally of a hardy, long-legged, coarse, open-fleeced animal, which yielded according to attention and feed, from 1½ to 4 lbs. of

to modern times the unrivalled race of the Merino. The limited region of Italy, overrun as it repeatedly was, during and after the times of the late Emperors, by hordes of barbarians, soon lost her pampered flocks, while the extended regions of Spain, intersected in every direction by almost impassable mountains, could maintain their more hardy race, in defiance of revolution or change.* The conquest by the Moors of a part of those fine provinces, so far from checking, served rather to encourage the production of fine wool. They were not only enterprising, but highly skilled in the useful arts, and carried on extensive manufactories of fine woolen goods, which they exported to different countries. After their expulsion in the 15th century, by Ferdinand and Isabella, the Spaniards preserved these manufactures in part, and sedulously cherished their fine flocks, and knowing the incomparable advantage they had in them, their sovereigns, except in a few isolated instances, strictly prohibited their exportation.

Exportation of Merinoes from Spain.—History asserts that Henry VIII of England, by permission of Charles V, imported 3000 sheep, but of what kind is not mentioned, they having numerous varieties in Spain. If of the true Merino, it will explain the superior quality of the English middle-wools, the Ryeland, South Downs and some others. The first well authenticated exportation of the Merino, was made to Sweden in 1723, by Alstroemer, which solved the problem of their capacity for sustaining their character, on rough fare and in a high northern latitude. Lasteyrie, who wrote 50 years after the experiment had been tried, speaks of their improvement both in carcass and the quality and quantity of fleece. The next exportation was made to Saxony, in 1765, and consisted of 105 rams and 114 ewes, but from what flocks they were taken, history nowhere mentions. A second exportion to that country, was made in 1778, of 110 that

* Whatever distrust may be attached to these scraps of History, which apparently establish the remote antiquity of the Merino; this much is absolutely certain, that they are a race whose qualities are inbred to an extent surpassed by no others. They have been improved in the general weight and evenness of their fleece, as in the celebrated flock of Rambouillet; in the uniform and excessive fineness of fibre as in the Saxons, and in their form and feeding qualities in various countries; but there has never yet been deterioration either in quantity or quality of fleece or carcass wherever transported, if supplied with suitable food and attention. Most sheep annually shed their wool if unclipped; while the merino retains its fleece, sometimes for five years, when allowed to remain unshorn. This we conceive affords conclusive evidence of long continued breeding among themselves, by which the very constitution of the wool-producing organs beneath the skin, have become permanently changed, and this property is transmitted to a great extent even among the crosses, thus marking them as an ancient and peculiar race.

were variously selected from the best flocks in Spain. From these have descended the high bred, silken-fleeced Saxons, whose wool stands confessedly without a rival. In 1775, the Empress Maria Theresa imported 300 Merinos into Germany, and placed them on the imperial farm in Hungary. In 1786, an importation was made into Denmark and her provinces; and again, in 1797, another flock of 300 was brought into the kingdom, and placed at Esserum, about eight leagues from Copenhagen. In 1786, 100 rams and 200 ewes were imported into Prussia, most of which were allowed to perish from disease, but their places were fully made up by later importations. The same year, 400 ewes and rams were selected from the choicest Spanish flocks, and placed on the Royal farm of Rambouillet, in France, which laid the foundation of the celebrated flock which bears that name. A small flock of inferior animals was clandestinely procured by George III, of England, in 1788, which attracted little attention. In 1791, a small but choice flock, was presented to that monarch, by the Cortes of Spain, which soon acquired high favor among many intelligent breeders. A part of these were kept pure, and their descendants furnished the superb flock of 700 nigrettis, which procured for their owner, Mr. Trimmer, in 1829, the gold medal from the London Society of Arts Others were mixed with different flock, in the kingdom, to the evident improvement of their fleeces.

THE FIRST IMPORTATION OF MERINOES INTO THE UNITED STATES which resulted in the propagation of a pure breed,* was made by Chancellor Livingston, then minister at the court of Versailles, who sent two choice rams and ewes from the Rambouillet flock in 1802, to Claremont, his country seat on the Hudson. In the latter part of the same year, Col. Humphreys, our minister in Spain, sent out nearly one hundred Merinoes, which were followed by more numerous flocks from the same and other sources. The largest importations of the Merino, however, were made through Mr. Jarvis of Vermont, then U. S. Consul in Spain, in 1809, and immediately thereafter. He first shipped, as he states, "200 Escurial, afterwards, 1400 Paulars, 1700 Aqueirres, 100 Nigrettis and about 200 Montarcos. 2700 Montarcos, were sent out by a Spaniard and Portuguese, and about 300 Guadaloupes by others; also 200 to 300 Paulars, by Gen. Downie, to Boston.

* One or more pure Merinoes, were imported into Massachusetts, in the latter part of the last century, by a citizen of that state, but they were soon mixed with other flocks, and resulted in the perpetuation of no distinct flocks.

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Of the Montarco flock shipped by others, about 2500 came to Boston, Providence, New York, and other ports. All were imported in the latter part of 1809 and '10, and early in 1811, and were the only Leonese Transhumantes, if we include Humphrey's and Livingston's, (which I have no doubt were of the same stock,) that were ever shipped to the United States."

VARIETIES OF THE SPANISH SHEEP.—Besides several other breeds of sheep in Spain, consisting of long and coarse wool and that of a medium staple, embraced under the different names of *Chorinoes*, *Choaroes* or *Chunahs*, the Merino is distinguished by two general divisions; the *Transhumantes* or travelling, and the *Estantes* or stationary flocks. The former are subdivided according to the Provinces they occupy, into Leonese, Segovian and Sorian. Many of the Estantes were of the best quality in respect to carcass, constitution and fleece, and such as were highly bred and in the hands of intelligent breeders, were not surpassed by any of the Spanish flocks. There were also many choice sheep among the Segovian and Sorian Transhumantes, but in general they were decidedly inferior to those of Leon. These last were universally regarded as the prime flocks of Spain. They comprised the Escurial, the Paular, the Nigretti, the Aqueirres or Muros, the Montarco, the Guadaloupe, Infantado and some others.

There is much contradictory testimony as to the comparative merits of the last mentioned flocks, as they were found in Spain; which is owing in part, doubtless, to the difference in the specimens subjected to examination. We subjoin some of the most reliable authorities on this subject. M. Lasteyrie, who investigated this matter closely says, "the Guadaloupe have the most perfect form, and are likewise celebrated for the quantity and quality of their wool. The Paular bear much wool of a fine quality, but they have a more evident enlargement behind the ears, and a greater degree of *throatiness*, and the lambs have a coarse hairy appearance which is succeeded by excellent wool. The lambs of the Infantado have the same hairy coat when young. The Nigretti are the largest and strongest of all the travelling sheep in Spain." Mr. Livingston says, "The Escurial is the most perfect of all the travelling flocks in Spain; the Guadaloupe for form, fineness and abundance of the fleece; the Paular with similar fleeces are larger bodied. Those of Castile and Leon have the largest with the finest coat. Those of Soria are small with very fine wool; and those

also of Valencia which do not travel, and like the last have fine wool but of a very short staple." Mr. Jarvis, who spent many years in Spain under every advantage for studying them closely, and who imported and has since bred large numbers of them on his estate in Vermont, says, "The Paulars were undoubtedly one of the handsomest flocks in Spain. They were of middling height, round bodied, well spread, straight on the back, the neck of the bucks rising in a moderate curve from the withers to the setting on of the head, their head handsome, with aquiline curve of the nose, with short, fine glossy hair on the face, and generally hair on the legs, the skin pretty smooth, that is, not rolling up or doubling about the neck and body, as in some other flocks; the crimp in the wool was not so short as in many other flocks, the wool was somewhat longer, but it was close and compact, and was soft and silky to the touch, and the surface was not so much covered with gum. This flock was originally owned by the Carthusian friars of Paular, who were the best agriculturists in Spain, and was sold by that order to the Prince of Peace when he came into power. The Nigretti flock were the tallest Merinoes in Spain, but were not handsomely formed, being rather flat-sided, roach-back and the neck inclining to sink down from the withers; the wool was somewhat shorter than the Paular and more crimped, the skin was more loose and inclined to double, and many of them were wooled on their faces and legs down to their hoofs. All the loose-skinned sheep had large dewlaps. The Aqueirres were short-legged, round, broad bodied, with loose skins, and were more wooled about their faces and legs than any other flock I ever saw, the wool was more crimped than the Paular, and less than the Nigretti, but was thick and soft. This flock formerly belonged to the Moors of Spain, and at their expulsion, was bought by the family of Aqueirres. The wool in England was known as the Muros flock, and was highly esteemed. All the bucks of these three flocks had large horns. The Escurials were about as tall as the Paulars, but not quite so round and broad, being in general rather more slight in their make; their wool was crimped, but not quite so thick as the Paular or Negretti, nor were their skins so loose as the Nigretti and Aqueirres, nor had they so much wool on the face and legs. The Montarco bore a considerable resemblance to the Escurials. The Escurial flock had formerly belonged to the crown, but when Philip the II built the Escurial palace, he gave them to the

friars, whom he placed in a convent that was attached to the palace, as a source of revenue. These four flocks were moderately gummed. The Guadaloupe flock was rather larger in the bone than the two preceding, about the same height, but not quite so handsomely formed, their wool was thick and crimped, their skins loose and doubling, their faces and legs not materially different from the two latter flocks, but in general they were more gummed than either of the other flocks. In point of fineness there was very little difference between these six flocks, and as I have been told by well informed persons, there is very little difference in this respect among the Leonese Transhumantes in general. The Escurials, the Montarcos and the Guadaloupes were not in general so heavy-horned as the other three flocks, and about one in six of the bucks were without horns."

The Saxon, we have before seen, is one of the varieties of the pure bred Merino, the foundation of which was laid by an importation of some of the choicest animals into Saxony, in 1765. The great care and attention bestowed upon these sheep by the Elector, the nobility and the most intelligent farmers, soon carried them to a point of uniformity and excellence of fleece, never exceeded by the best of the original flocks. The breeders were selected with almost exclusive reference to the quality of the fleece. Great care was taken to prevent exposure throughout the year, and they were housed on every slight emergency. The consequence of this course of breeding and treatment has been, to reduce the size and weight of fleece, and partially to impair that hardiness and vigor of constitution, which universally characterised the original Transhumantes. In numerous instances, this management resulted in permanent injury to the character of their flocks, which America has severely felt in several importations of worthless animals, which a too great eagerness for improvement, induced her flockmasters to use with the Spanish Merinoes and their descendants, as a means for this object, but which has resulted in the introduction of fatal diseases and serious deterioration in their flocks.

The first importation of Saxons into this country was made in 1823, of four good rams, two of which went to Boston and the others to Philadelphia. The next was made the following year, and consisted of 75 rams and ewes which were brought to Boston and sold at public auction, and afterwards were scattered over the country. Another lot of 180 followed to the same place, the next year, and was sold in the

same manner, but at an increased price, some selling as high $450 each. These prices excited the spirit of speculation, and the following year witnessed the importation of near 3000, many of which were decidedly inferior. These were all thrown upon the market for the most they would command, and in many instances, the sales not half covering the cost of importation, the enterprise was abandoned as a speculation, or commercial operation. The late Henry D. Grove, of Hoosic, New-York, a native of Germany, and a highly intelligent and thoroughly bred shepherd, accompanied some of the best early importations to this country. He selected 105 choice animals for his own breeding, which he imported in 1827, and 70 more equally good, in 1828, and with these he formed the flock from which he bred to the time of his decease, in 1844.*

The Rambouillet flock was founded in 1786, by Louis XVI, from a selection of 400 of the best Spanish sheep, which were placed on the royal farm at Rambouillet. These, like the Saxon, received all the attention which intelligence and wealth could bestow, and the consequence was soon manifest in their larger size, and the increased weight and uniformity in the fineness of their fleece; the last improvement being particularly evident in the absence of the coarse wool which in many cases infested the quarters, and the jarr, or hair which frequently abounds on the flanks, legs and thighs of the original merino. Besides the crown flocks at Rambouillet, they are found in equal perfection on several other of the royal farms, especially those of Malmaison, Perpignan, Arles, Clermont, and some others. These flocks have been bred for hardy constitution, large carcass and heavy fleece, of as much fineness as consistent with large weights, and as uniform in quality throughout, as possible. Mr. Gilbert, who was

* The average weight of fleece from the entire flock of Mr. Grove, nearly all of which were ewes and lambs, as stated by him to the writer, in 1842, was 2 lbs. 14 ounces, thoroughly washed on the sheeps' back. This was realized after a short summer and winters' keep, when the quantity of hay or its equivalent, did not exceed by actual weight, 1¼ lbs. per day, except to the ewes, which received an additional quantity just before and after lambing. This treatment was attended with no disease or loss by death, and with an increase of lambs, equalling one for every ewe.

In a flock of pure Saxony sheep owned by Mr. Smith of Connecticut, as stated in a letter from the owner, published in the American Shepherd, 104 ewes raised 101 lambs, and yielded 341 lbs of wool, which sold at 70 cents per lb. For the 18 months preceding, he lost but three animals out of 300, from ordinary casualties. But some flocks of pure Saxony, do not, in good condition, average over 2 lbs. per head. A recent importation (May, 1846) made by Mr. Taintor of Connecticut, consisting of four bucks and four ewes, from the celebrated Saxon flock of Baron de Spreck, shew a size and vigor of constitution equal to any of their Merino progenitors.

particularly familiar with them, says, "almost all the fleeces of the rams, from two years old and upwards, weigh (unwashed) from 12 to 13 lbs.; but the mean weight, taking the rams and the ewes together, has not quite attained to 8 lbs., after deducting the tags and the wool of the belly." The French pound is about one-twelfth heavier than the English; but from the general custom of folding the sheep in France, feeding them in fallows, and wintering them in houses, the fleece becomes very dirty. The loss in washing (fit for manufacturing) is about 60 per cent., so that the clean fleece of the ram will average about 6 lbs., and that of the whole flock, something under 4 lbs.

The first importation of the Rambouillet's to this country, was in 1801, by M. Dellesert, of Paris, for M. Dupont, then in New-York, and consisted of 4 choice rams, only one of which, Don Pedro, reached this country. He was used among the native ewes near Kingston, N. Y., for three years, and then transferred to Delaware, where he effected great improvement among the native flocks. The second was that made by the late Chancellor Livingston, before alluded to. There was another in 1840, by Mr. Collins, of Connecticut, comprising 30 select ewes and 2 rams. All these sheep possessed the characteristics peculiar to the variety as described. A still more recent importation has been made by Mr. Taintor, of Connecticut, (during the present summer of 1846,) of 23 ewes and 3 bucks.*

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* We subjoin a description of these from the Editor of the American Agriculturist, New-York. The rams, though young, are the most promising animals of their breed we ever saw, and when full grown, will weigh at least from 225 lo 250 lbs. each. The sire of one was sold the past season for $500. He sheared 23 lbs. of unwashed wool To give an idea of the ewes, we measured them after they were shorn, and found they varied from 25½ to 29 inches in height over the withers; and lest it may be thought this superior height is attained by extra long legs, we will add, that the height of the under side of their bodies from the ground, was from 9½ to 12 inches; which, according to our observation, is no greater in proportion to their size, than that of good American Merino sheep. Their weights we took after being shorn. They varied from 124 to 153 lbs. Some of them were quite thin in flesh, the largest especially, which, if in fine condition and her fleece on, would weigh at least 200 lbs. The following is the weight of their fleeces unwashed. We took them ourselves in the presence of several witnesses, and as fast as shorn from the ewes' backs The scales we used did not mark less than one quarter of a pound, which will account for the absence of odd ounces.

No. 17	13 lbs.	No. 100	12¼ lbs.
" 27	15 "	" 109	17 "
" 64	16¾ "	" 110	17 "
" 71	14½ "	" 117	16¾ "
" 84	16½ "	" 118	15¾ "
" 87	16¼ "	" 133	14¾ "
" 94	17 "	" 195	13½ "
	109		107

The fleeces were about fourteen months old, but they had lost some on their voyage out, and on account of the lateness of the season, were not shorn near as

THE PROGRESS OF THE MERINO IN THE UNITED STATES. —Though reaching back but half a century, the Merino flocks of this country have been very fluctuating as to their value, increase and improvement. When first introduced, they were viewed with distrust by the majority of our farmers; and it was not till after several years' experience of their paramount merits, that they were generally disseminated. But the confidence of our flock-masters having once been secured, it has never been withdrawn, and they have ever since, been cherished favorites. The prices for choice Merinos rapidly increased after a few years, and Livingston states the average price for rams, in 1811, at $1000, and some were sold at a much higher rate. This was the period of the embargo, when our infant manufactures were just starting into life; and being followed by war with the greatest commercial nation of the world, we were thrown entirely on our own resources for the supply of our woolen and other fabrics, and wool and sheep maintained their full value till the return of peace, in 1815. The flooding of our country with foreign goods, under low duties, which succeeded this event, either broke down or effectually paralyzed our woolen manufactures, and wool, of course, felt the full weight of this crushing influence. The Merino rapidly declined in value, till its price nearly approximated to that of the native sheep. Their merits had, however, become so conspicuous, that the low prices produced a more general diffusion, and they and their crosses were thus sown broad-cast over the country.

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close as it is customary; besides, on several of them, from half to one pound of the wool was left on the heads and legs, for the purpose of giving an idea of their fleeces to those who may call hereafter to look at them. Taking all these things into consideration, it was the unanimous opinion of several sheep-masters present, that the wool clipped from these ewes was not more than would have been equivalent to one year's growth. We shall not compare the weight of these fleeces with what is generally termed CLEAN WASHED wool, as it is the most uncertain and unsatisfactory comparison which can be made, for when it comes to be cleansed by the manufacturer, it will vary in loss from 20 to 50 per cent. just as the case may happen. It was the unbiased opinion of several wool dealers present, and our own, that the shearing above would yield at least 35 lbs. of CLEANSED wool, fitted for manufacturing without further loss, out of every 100 lbs. shorn. The fourteen ewes yielded 216 lbs. unwashed, which would be equivalent to 75 lbs. 10 oz. thoroughly cleansed, or an average of 5 lbs. 6 oz. per head. If any of our readers are desirous to know what this would come up to, CLEAN WASHED, they may safely add one-third. This would bring the average as wool growers usually dispose of their fleeces, to 7 lbs. 3 oz. per head, a yield totally unprecedented in this country. The usual average weight of good Merino ewes is about half this. The average of the flocks in Europe from which these sheep were chosen, is, for rams from 15 to 17 lbs. per head; for ewes 11 to 13 lbs., unwashed. The average price of such wool in its unwashed state, is 26 cents per lb. of our money. These sheep show great vigor of constitution, and are remarkably well formed, with enormous dewlaps and folds all over the carcass. Their fleeces are very close, thickly covering the head and legs as well as the body, and are uncommonly even, the wool being nearly as good on the flanks as on the shoulders, while its felting properties are unsurpassed. In fineness of quality it is equal to the best American Merino.

The introduction of the Saxons, in great numbers, in 1826, many of which were excessively diminutive and diseased, and their indiscriminate use with our pure bred Merinos, was a serious interruption to the career of improvement in many of our flocks. Their mixture with the best Saxons was no further detrimental, than to reduce the quantity of fleece, and to a certain extent, lessen the peculiar hardiness of the original Transhumantes, which had been fully preserved by their descendants in this country. The use of well selected Saxon rams with Merino flocks was extensively practised, and it is still persisted in by intelligent flock-masters, after 20 years' experience, who are satisfied that they find it for their interest to continue this style of breeding. The animals being smaller, consume less, and they probably produce a quantity of wool in proportion to their food, which, from its improved and uniform quality, commands a higher price in the market. Wherever they are not sufficiently hardy, they can be bred back towards the Spanish Merino standard, by the use of some of the stouter rams. Their natures are intrinsically the same. They are only divergent streams from the same original fountain, and when again united, they readily coalesce and flow onwards, without violence or disorder.

The Merino, as might reasonably have been anticipated, when properly managed, has improved from a variety of causes. Though kept scrupulously pure in Spain, they were seldom bred with that refinement of taste, or that nice judgment which distinguishes the accomplished modern breeders. Their management was too entirely entrusted to ignorant shepherds or careless agents, to secure that close attention which is essential to improvement. The sheep had to perform a journey of several hundred miles twice in a year, to and from their distant Sierras; and it was absolutely essential that strong animals should be selected for breeding; and to secure this object, those were frequently used which were deficient in the most profitable qualities. They were also closely bred in-and-in, seldom or never departing from a particular flock to procure a fresh cross. Their wild, nomadic life, approaching nearly to that of their natural state, and their peculiarly healthful pasturage, alone prevented a serious deterioration from this cause. When brought into the United States, the flocks were soon mingled with each other, and for many years past, probably, not an unmixed descendant of any distinct original flock could be traced. Abundance of appropriate food has been given them, without the labor of long

and fatiguing journeys ; and lastly, there has been much care used in the selection of the most profitable animals for breed. The spirit of improvement has been recently awakened to this important branch of American husbandry, and if not arrested by any untoward national policy, it will soon result in giving us numerous flocks of as choice sheep as the world affords, as we have already all the elements within ourselves for its attainment.

PECULIARITIES OF THE MERINO.—The prominent peculiarities of the Merino, are the abundance and fineness of its fleece, the tenacity with which it is held, its crimped or spiral form, its felting properties, and the excessive quantity of yolk, giving to it that softness which distinguishes it from all others. Their large horns are common to several other varieties. Their hoofs are sometimes singularly long, reaching 8 or 10 inches when allowed to grow. The horns, hoofs and wool scarcely differ in their chemical constituents, and the peculiar development of the two former, is justly considered as an additional evidence of their wool-bearing properties. The yolk in most of the sheep, forms, with the dust which adheres to it, a firm crust on the exterior, and together with the compactness of the fleece, it offers considerable resistance to the open hand on being pressed, giving the impression of rigidity. This outer covering repels the rain, the snow, and the wind like a coat of mail, thus fitting the Merino to endure exposure better than any other sheep. On opening the crust, the wool is found of a brilliant, golden hue, sparkling with yolk, and firmly held together in masses, hardly distinguishable from the cocoon of the silk-worm. The wool closely covers every part of the body, and frequently the entire legs and head, excepting a part of the face.

Another peculiarity of the Merino is its longevity. They attain a great age when properly managed, and in healthy localities, sometimes breed till 20 years of age. The Merino may be described, generally, as a small-boned, closely made, medium sized sheep, varying from 80 lbs. of live weight for a small ewe, to 160 lbs. for good sized wethers and rams, in ordinary condition. They are light in the shoulders and chest, and are, altogether, more deficient in form than the best mutton sheep. This apparent difference is materially lessened when both are denuded of their fleece ; as the longer pile of the latter covers defects, which would manifest themselves under the closer covering of the Merino. Yet, with this seeming deficiency, Young found, in feeding, between

the Merino and Bakewell, that the latter ate the most, and gained the least, in the ratio of two to three. We give the statement as we find it, though it apparently contravenes a fundamental principle, which a knowledge of all the circumstances of the trial, the peculiarities of the particular animals, &c., might probably explain satisfactorily. The mutton is excellent, and it is probably, not surpassed by that of any other sheep. Lord Somerville claims it as a rule, that the quality of the flesh in each class of sheep, follows that of the wool, and that the flesh of the short and fine-wooled sheep is closer in the grain and more highly flavored than the long-wooled. Sir Joseph Banks says, the London butchers, after having some of their Merinos, eagerly sought for more, from its popularity with their best customers; and it is certain that the flavor of our mountain fed Merino does not suffer in comparison with the choicest breeds.

Breeding Merinos.—The general principles of breeding cattle and sheep, as laid down by the most approved authorities, must be taken with some exceptions, when applied to the Merino. Good form and feeding qualities are desirable in this breed, but they are not as essential as with the others. *Wool* is the great object, and if this be sufficiently fine, even and abundant, something may be abated in the perfection of form. Early maturity, so much sought after in the mutton sheep, cannot be reconciled with the great longevity, and the prolonged productive powers of the Merino. We must content ourselves therefore, with slowly engrafting such improvements on the breed, as can be effected without prejudice to his other good qualities, and look to his crosses with others for such qualities as are irreconcilable with his nature. It is considered indispensable to the improvement of the Merino, that it be not bred too young. A vigorous ewe may bring her first lamb at two years old, but it is better that it be deferred till three. The ram should never be used till his second year; and then but sparingly. From 2½ to 6 years old is deemed the most vigorous age, though many may be safely used till 8 or 10, and occasionally later. Both ewes and rams have been known to breed till 20 years old.

The ram should be large, stout and well made, carrying his weight as compactly as possible. The nose should be convex; the face covered with a soft velvety hair; the eye lively and prominent; the veins near the lachrymal glands, of a clear red; the horns rough; short neck; pendant dewlap not objectionable; full chest, broad shoulders; broad,

level back; large quarters; tail large and well set up; good legs, and sound hoofs; with a firm, easy, regular gait; the head carried high, with a look of boldness and decision, without in any degree approaching to wildness or ferocity. *The ewe* should possess these characteristics generally, with such modifications as are suited to the sex. Great care should be taken to breed from such as are most perfect in all the essential points of constitution, form and size; and weight, uniformity and fineness of fleece. The closest observation is requisite to select the best in all respects.

In-and-in breeding should be avoided where practicable, which can be done where there is a careful registry of the sheep, for successive generations. Excessive use of rams can never be permitted without decided injury to them and their progeny. In Spain, four rams are supplied to every hundred ewes. This limited number is proper enough, where they undergo so much fatigue in travelling, and kept too, as they are, entirely on grass. But if moderately grained before and during their use, and especially if kept up, and allowed to serve the ewes once only as they come in heat, the number may be largely increased. A vigorous ram will suffice for 35 to 40 ewes, when running with the flock; yet his powers would not be more taxed by double or even treble this number, if admitted to each but once. Bread is a convenient food for the ram while running with the sheep. If he is gentle, which he should always be, he will come up readily and eat from the hand, without exciting the attention of the other sheep which crowd, and not unfrequently injure each other when grain is placed before him; or they may be stabled at night when they are fed with grain. If young ewes have stolen lambs, they should be taken away from them immediately after yeaning, and the nourishment supplied to the lamb from the milk of a cow. The tax of nursing is nearly equal to that of gestation, and farther injury to the dam may be avoided by this practice. Merino ewes have had the reputation of being indifferent nurses in Spain. This is owing to their fatigue in travelling, and frequently to scanty pasturage, instead of any constitutional deficiency. It is a frequent practice there, to kill a part of the lambs and put one on to two ewes. This has never been found necessary in the countries where they have been transplanted, as generous feed for the dams, has invariably been found entirely adequate to their support of the young.

The localities in which Merino sheep can be profitably kept in the United States, are wherever the pastures are sweet and dry; the climate not too hot, and the land not too valuable for other purposes. Wool is the great object in the sheep husbandry of this country, and when sheep farms are remote from the large markets, the Merino will make much the most profitable returns. In the neighborhood of cities, where large and fat sheep and early lambs bear a high price, the mutton sheep may be substituted.

THE SOUTH-DOWN.—This valuable sheep has been known and bred for a long time on the chalky downs of England, where it has always maintained the character of a hardy animal, yielding a medium quality of wool, and furnishing mutton of a superior flavor. It was not however, till within the last 70 years, that any considerable attention was devoted to its improvement. Since that period, its fine points have been remarkably developed, which is shown in its improved size and form, and its early maturity and productiveness. The late Mr. John Ellman of England, was the first who took them thoroughly in hand; and so eminent was his success, that he founded a flock which has been the source from which all the best blood has been since derived. His criterion of a good South-Down is as follows:—"The head small and hornless; the face speckled or grey, and neither too long nor too short. The lips thin, and the space between the nose and the eyes narrow. The under jaw, or chap, fine and thin; the ears tolerably wide, and well covered with wool, and the forehead also, and the whole space between the ears well protected by it, as a defence against the fly. The eye full and bright, but not prominent. The orbits of the eye—the eye-cap, or bone,—not too projecting, that it may not form a fatal obstacle in lambing. The neck of a medium length, thin towards the head, but enlarging towards the shoulders where it should be broad and high, and straight in its whole course above and below. The breast should be wide, deep, and projecting forwards between the fore legs, indicating a good constitution, and a disposition to thrive. Corresponding with this, the shoulders should be on a level with the back, and not too wide above; they should bow outward from the top to the breast, indicating a springing rib beneath, and leaving room for it. The ribs coming out horizontally from the spine, and extending far backward, and the last rib projecting more than the others; the back flat from the shoulders to the setting on of the tail; the loin broad and flat;

the rump long and broad, and the tail set on high and nearly on a level with the spine. The hips wide; the space between them and the last rib on either side as narrow as possible, and the ribs, generally, presenting a circular form like a barrel, The belly as straight as the back. The legs neither too long nor too short. The fore-legs straight from the breast to the foot; not bending inward at the knee, and standing far apart both before and behind; the hocks having a direction rather outward, and the twist, or the meeting of the thighs behind, being particularly full; the bones fine, yet having no appearance of weakness, and of a speckled or dark color. The belly well defended with wool, and the wool coming down before and behind to the knee, and to the hock; the wool, short, close, curled, and fine, and free from spiry projecting fibres."

Other breeders have commenced where Ellman left off, and have apparently pushed their improvement to its utmost capacity; and especially has this been done by Messrs. Grantham and Webb, the latter of whom, while preserving all the essential merits of the sheep, has carried the live weight of breeding rams, to 250 lbs., and well fattened wethers to 200 lbs. dressed weight. Many of the choicest animals have been imported into this country, and they are now to be found in limited numbers in almost every State of the Union. The wool was formerly short and used only for cloths, flannels, &c. It has been considerably lengthened in many of the late flocks, and with the improvements in the combing machinery, is now much used in England, as a combing wool. The quantity produced is nearly equal to that of the Merino flocks when well kept, varying according to the size and style of breeding, from 3 to 4 lbs. of clean washed wool, which in quantity, does not differ materially from half-blood Merino, and sometimes rather exceeds it. The larger animals of course, produce fleeces of much greater weight, sometimes reaching to 8 or 9 lbs. The South Down will subsist on short pasture, but well repays full feeding. It attains early maturity, is hardy and prolific, frequently producing two at a birth. Like all highly improved English breeds, it is not a long-lived sheep. It may be considered in its prime at three. The wethers may be fattened at 18 to 30 months, and the ewes at 3 to 5 years, when first required as breeders. The last are sometimes allowed to come in with a lamb at a year, but they cannot be sustained in vigor, if put to breeding before two.

The Chevoit is thus described by Blacklock: "They have a bare head, with a long jaw, and white face, but no horns. Sometimes they have a shade of grey upon the nose, approaching to dark at the tip; at others, a tinge of lemon color on the face, but these markings scarcely affect their value. The legs are clean, long, and small-boned, and covered with wool to the hough; but there is a sad want of depth at the breast, and of breadth both there and on the chine. A fat carcass weighs from 12 lbs. to 18 lbs. per quarter, and a medium fleece about 3 lbs. The purest specimens of this breed are to be found on the Scotch side of the Chevoit hills, and on the high and stony mountain farms which lie between that range and the sources of the Tevoit. These sheep are a capital mountain stock, provided the pasture resembles the Chevoit hills, in containing a good proportion of rich herbage." They are eminently adapted to high lands and a severe climate, though less so than the Black-faced or Heath sheep of Scotland. They have become an American sheep, by their repeated introduction into this country. A late importation of several choice sheep was made by Mr. Carmichael of New-York. The wool on these is from 5 to 7 inches long, coarse, but well suited to combing. Like the Downs, it has heretofore been classed among the *middle wools,* but these specimens would seem to indicate that they are verging towards the long wools.

The Bakewell or Leicester, the Cotswold and Lincolnshire possess several qualities in common, and it is only a practiced eye that can readily detect the difference. This resemblance arises from a recent, common origin. They are all large and hornless; of a pure white; with long, coarse and heavy fleeces; excellent mutton sheep; coming early to maturity, and capable of carrying enormous quantities of fat. There have been from time immemorial, numerous flocks of these large, coarse wooled sheep, existing in certain parts of England under a variety of names, and partaking of some slight peculiariry of features, according to the district in which they are bred. Thus, besides those above mentioned, there were the Teeswater, the Romney Marsh, the Kentish, the Bampton, the Exmoor, &c., all of which were deficient in form, slow feeders, and late in coming to maturity.

Improvement of the Long Wools.—The late Robert Bakewell first commenced a decided improvement with the Leicesters, nearly a century since. He began by selecting the choicest sheep in England, which possessed the essential qualities;

and by judicious feeding and management throughout, he soon brought them up to a character widely differing from the original with which he started. So eminent was his success, that in 1787, he let three rams for 1250 pounds, (about $6,200,) and was offered 1050 pounds, (about $5,200,) for 20 ewes. Soon after this, he received the enormous price of 800 guineas, or $4,000, for the use of two thirds of a single ram for a season, reserving the other third for himself. He reduced the bone and offal or worthless parts of the carcass, and increased the weight of the valuable parts, and especially their tendency to fatten and early maturity. This was effected mainly, by a nice discrimination, which has probably never been surpassed, if it has ever been equalled. He selected medium sizes for the breed, with as much evenness and perfection of form as possible, for he found that excellence and profitable feeding qualities were seldom connected with extra size, large bones, or imperfect form. He also observed the disposition to fatten in individuals, and used only such as were conspicuous in this respect. He relied more than all upon their quality of *handling* well, depending even more upon the elastic, mellow touch, than upon the most symmetrical figure. He used only the choicest rams, a little under size, while the ewes were of full medium weight. The progeny were pushed with a full supply of nutritious food, and systematically brought to early maturity. Connected with this, was his practice of *in-and-in breeding*, or breeding the parent upon the progeny, for several successive generations, which had the tendency still further to refine the bone and offal, and impress most effectually, the desirable characteristics of the race. It is even credibly asserted, that he produced rot in such of his fattening sheep as he wished to mature early for the shambles, as in the first stages of that loathsome disease, the fat-secreting organs accomplish their office more rapidly than in a state of perfect health, and it at least secured them against breeding when they left his own hands. It is certain, that Bakewell carried his refining system to such an extent, as partially to destroy the procreative powers; and he was subsequently obliged to introduce new animals to reinvigorate and continue his flock. The general system of Bakewell, however, was attended with complete success. He produced a race of animals, not only far beyond what England had ever before seen, but which, in all the qualities he endeavored to establish, have not been exceeded since; and his *improved Leicesters* have come down to the present

day as perfect as he left them, showing conclusively, that he not only formed, but stamped the peculiarities of the breed, with a permanence which yet bears witness to his genius. One of these attained the enormous live weight of 368 lbs., and dressed, 248 lbs.

The Cotswold and Lincolnshire.—Other breeders were not slow in following in Bakewell's footsteps with different breeds, and the Cotswold and Lincolnshire especially, have become the subjects of an equally decided improvement, while the errors of Bakewell were entirely avoided. They possess a rather more desirable robustness, approaching in some few specimens, almost to coarseness, as compared with the finest Leicesters; but they are more hardy and less liable to disease. They attain as large a size and yield as great an amount of wool, of about the same value. These breeds scarcely differ more from each other, than do flocks of a similar variety, which have been seprately bred for several generations. They are prolific, and when well fed, the ewes will frequently produce two lambs at a birth, for which they provide liberally from their udder till the time for weaning. The weight of the fleece varies from 4 to 8 lbs. per head.

Peculiarity of long wool and its uses.—The striking peculiarity of the long wools, is in the production of a fleece, which is perfectly adapted, by its length and the absence of the felting property, to the manufacture of worsted stuffs, bombazines, mousseline de laines, &c. This is a branch of our manufactures for which we had little material that was suitable, till the introduction of the long wools; and its rapid extension within the past few years, clearly shows, that a large and increasing demand for this kind of wool will continue at remunerating prices. Besides its uses for combing, it is extensively manufactured into blankets, carpeting, and many other fabrics.

Importation of Long Wools.—Several of the Bakewells were imported during the last century; and many flocks containing some of the best specimens, have been introduced and scattered over every section of the country. The largest of any single importation of the long wools, was made by Messrs. Corning & Sotham, in 1842, and immediately preceding, and consisted of 70 or 80 choice Cotswolds.

Breeding the Long Wools.—Some information on this subject will be found under the head of *breeding Merinos*, and *improvement of the Long Wools*. The ram and ewe should be selected from the best specimens of the breed which is to be

perpetuated. There are peculiarities of form or appearance in each, which should be carefully observed. Neither should a *violent cross* ever be taken for the purpose of perpetuation, as suggested, under the head of principles of breeding, in a previous chapter; such as between those possessing totally opposite properties, as the Merino and Long Wools; and there is no conceivable advantage in mixing the middle wools, South Downs, &c., with either. Lord Western has long experimented on the blending of the Merino and Long Wools through several generations, without any success, nor is it believed to be attainable. There is no evenness or integrity of character either in the animal or fleece from such mixtures, nor is it possible to foretel the character of progeny from such bastard crosses. The general rule, that like begets like, will not hold true here, for the animal comes large or small, with a long or short fleece, fine or coarse, or intermixed; and this too is repeated through numerous generations, when the immediate parents exhibit properties altogether unlike the offspring, and which it derives from some remote ancestry. This practice will do to produce lambs for the butcher, as the consequence of a fresh cross is greater stamina and thrift; and it is found that lambs thus bred, attain an early and full development. Thousands of such are annually bred on the banks of the Hudson, Long Island, and around our large cities, and in the worst possible way; as the large, coarse ram is used on the delicate Saxon ewe; yet the lambs thrive and command a good price in the market, and the owner is satisfied to pocket the result. Yet nothing could be more absurd than to propagate from such progeny for any other purpose.

The mixture of breeds of similar character, is attended with the best consequences. Such was the intermingling of the improved Leicesters with the Cotswold and Lincolnshire, by which the latter were refined; and such was the use of the latter with the Leicesters, when they became impotent and almost worthless from over-refinement in breeding. Good results have followed the mixture of the South and Hampshire Downs. A marked improvement in the Merino in this country, has been claimed by Mr. Jarvis, and several others, from the mixture of the various flocks, which for ages had been kept distinct in Spain; and the same result is known to have followed a similar course with the Rambouillet and Saxon flocks.

The ewe goes with young about five months, varying from 145 to 162 days. Each flock-master will of course deter-

mine what is the proper time for his lambs to come. For early market, or when there are few sheep, and those well looked after, they may come while the ewes are in the yards, and provision can be made for the progeny, by placing such as are heavy, in warm stalls. Both the dam and young thus receive a closer attention than they would in the field; and after a weeks housing in severe weather, the lamb may be turned out into the dry yard, where he will suffer no more, apparently, than the full grown sheep. But with large flocks, early lambing is attended with much trouble, and it is generally avoided, by deferring it till the weather has become more settled, and a full bite of grass will afford the dam a plentiful supply of milk. Yet in this case, the young sheep must daily be under the eye of the shepherd, who should see that they are well supplied with food, and especially that they are brought under cover in severe or stormy weather.

A ram will serve from 10 to 100 ewes in a season, according to his age, health, feed, and management. A South Down or Long Wooled lamb of 7 or 8 months, is sometimes used, and when this is done, he should be well fed, and allowed to run only with a very few ewes. If full grown rams are turned into a lean pasture to remain with the ewes, not less than four should be put in for every hundred. But if a well-fed ram, in full health and vigor, is kept up, and led out to the ewe as she comes into heat, and allowed to serve her once only, he will suffice for one hundred, without injury to himself or progeny. For this purpose, the ram should be prepared, not by being fat, for this, neither he nor the ewe should ever be; but by being fed with grain for a short time before and during the continuance of the season. The ewes are more likely to come quickly into heat, and prove prolific, if lightly fed with stimulating food at the time. It is reasonably enough conjectured, that if procreation, and the first period of gestation takes place in cold weather, the fœtus will subsequently be fitted for the climate which rules during the early stages of its existence. If this be so, and it is certainly in accordance with the laws of nature, fine wooled sheep are most likely to maintain their excellence, by deferring the connexion of the male, till the commencement of cold weather; and in the northern states, this is done about the first of December, which brings the yeaning time in the last of April or first of May, when the early grass will afford a good quality of feed.

WINTER MANAGEMENT AND FOOD.—Sheep should be brought into winter quarters soon after the severe frosts occur, as these diminish the feed, and materially impair its nutritious qualities. They ought also to be removed from the grass lands before they beco e permanently softened by the rains, as they will injuriously affect their comfort and health; and it is equally objectionable from their poaching the sod. If the number be large when brought to the yards, they must be carefully divided into flocks of 50 to 100, according to the size of the yards and sheds. The young and feeble must be separated from the others, and the ailing ones placed by themselves; and that no one may suffer from the others, all should be classed as uniformly as possible as to strength. The yards must be dry, well supplied with a trough of fresh water, and with comfortable sheds to which they can retire when they choose.

SHELTERS in northern climates are indispenable to profitable sheep-raising, and in every latitude north of the Gulf of Mexico, they would be advantageous. There is policy as well as humanity in the practice. An animal eats much less when thus protected; he is more thrifty, less liable to disease, and his manure is richer and more abundant. The feeding may be done in the open yard in clear weather, and under cover in severe storms. The shelters for sheep are variously constructed, to suit the taste or circumstances of the flockmaster. A sheep-barn built upon a side hill will afford two floors; one underneath, surrounded by three sides of wall and opening to the south, with sliding or swinging doors to guard against storms; and another overhead, if the floors are made perfectly tight, with gutters to carry off the urine; and sufficient storage for the fodder may be made by scaffolds. Or they may be constructed with 12 or 15 feet posts on level ground, allowing them to occupy the lower part, with the fodder stored above. In all cases however, *thorough ventilation should be provided*, for of the two evils of exposure to cold or too great privation of air, the former is to be preferred. Sheep cannot long endure close confinement without injury. In all ordinary weather, a shed closely boarded on three sides, with a close roof, is sufficient protection, especially if the open side is shielded from bleak winds, or leads into a well enclosed yard. If the apartment above is used for storage, the floors should be made tight, that no hay, chaff or dust can fall upon the fleece.

Racks or mangers are indispensable to economical feeding. If the hay is fed on the ground, the leaves and seeds, the most valuable part of the fodder, are almost wholly lost, and when wet, the sheep in their restlessness while feeding, will tread much of it into the mud. To make an economical box or rack, take 6 light pieces of scantling, say 3 inches square, one for each corner, and one for the centre of each side. Boards of pine or hemlock, 12 or 15 feet long and 12 or 14 inches wide, may then be nailed on to the bottom of the posts for the sides, which are separated by similar boards at the ends, 2½ feet long. Boards 12 inches wide, raised above the lower ones by a space of 9 to 12 inches, are nailed on the sides and ends, which completes the rack. The edges of the opening should be made perfectly smooth to prevent chafing the wool. The largest dimensions above given are suitable for the large breeds, and the smallest for the Saxon, and still smaller are proper for their lambs. These should be set on dry ground, or under the sheds, and they can easily be removed wherever necessary. Some prefer the racks made with slats, or smooth, upright sticks, in the form of the usual horse rack. There is no objection to this, but it should always be accompanied by a board trough affixed to the bottom, to catch the fine hay which falls in feeding. These may be attached to the side of a building, or used double. A small lamb requires 15 inches of space and a large sheep 2 feet, for quiet, comfortable feeding, and at least this amount of room should be provided around the racks for every sheep.

Troughs may be variously constructed. The most economical are made with two boards of any convenient length, 10 to 12 inches wide. Nail the lower side of one upon the edge of the other, fastening both into a two or three inch plank, 15 inches long and a foot wide, notched in its upper edge in the form required.

Food.—There is no better food for sheep than ripe, sound, timothy hay, though the clovers and nearly all the cultivated grasses may be advantageously fed. Bean and pea straw are valuable, and especially the former, which if properly cured, they prefer to the best hay; and it is well adapted to the production of wool. All the other straws furnish a good food, and sheep will thrive on them without hay when fed with roots or grain. *Roots* ought to be given them occasionally for a change, and especially to the ewes after lambing, if this occurs before putting them on to fresh pasture. They keep the stomach properly distended, the appetite and

general health good, and they render their winter forage nearly equal to their summer feed. Much grain is not suited to store-sheep. It is too rich, and should be given sparingly except to the lambs, the old ewes or feeble sheep, or to restore the rams after hard service. For the above purposes, oats are the best; and if any other grain, beans or peas are given, it should be in small quantities. When there is a deficiency of hay and roots, grain may be used with straw. But the flock ought to be so fed as receive the same amount of nourishment throughout every part of the year. The evenness and value of the fleece depends much upon this. When the amount of nutrition is great, the wool secreting organs are distended, and the fibre becomes enlarged; when limited, they necessarily contract and the fibre is small. This produces a want of trueness, which the experienced stapler readily detects, and does not fail to estimate against the value of the fleece. Sheep ought to have a full supply of salt, and if accessible, sulphur, ashes, tar and clay would frequently be nibbled by them when their stomach required either. Pine or hemlock boughs are a good substitute for tar, and afford a most healthful change in the winter-food of sheep. Entire cleanliness and dryness are also essential to the health of the flock. The smaller sizes of the Saxon may be well sustained on two pounds of hay, but larger sheep will consume from three and a half to four, or even five pounds per day. Sheep like all other animals when exposed to cold, will consume much more than if well protected, or than during a warmer season.

The care of the ewes wi'h young, is an important consideration, as the lamb is sometimes the only profit yielded by the flock, for when fodder is high or wool low, the fleece will barely pay for the food and attention. Pregnant ewes require the same food as at all other times, but caution is necessary to prevent injury or abortion, which is often the result of excessive fat, feebleness or disease. The first may be remedied by blood-letting and spare diet, and both the last by restored health and generous food. Sudden fright, as from dogs or strange objects; long or severe journeys; great exertions; unwholesome food; blows in the region of the fœtus, and some other causes produce abortion.

Yeaning.—Most flocks are turned into the pasture before yeaning time, and the ewe is then left to nature, which is a good practice if she is healthy and the weather good. But a larger number of lambs will be reared by a careful over-

sight of the ewes and the use of proper precautions. As their time approaches, which may be known by the springing of the udder and the enlargement of the natural parts, they should be put by themselves at night, in a warm stable or with others in the same condition, and well looked after, late and early in the day. They seldom need any assistance, nor should any be rendered, except in case of wrong presentation, or feebleness in expelling the fœtus. In the former case, the shepherd may apply his thumb and finger after oiling, and push back the young, and assist in gently turning it till the nose and fore-feet appear; and for the latter, only the slightest aid should be rendered, and that to help the throes of the dam.

Management of lambs..—When lambing in the field, only a few should be together, as the young sometimes get changed, and the dams refuse to own them. This dificulty is generally obviated by holding the ewe till the lamb has sucked two or three times; or they may be shut up together, and the lamb rubbed with a little fine salt. The lamb does not require nourishment for some hours; but if the dam refuse to lick it as soon as it appears, it must becarefully wiped dry. If the weather be cold and the lamb is dropped in the field, the shepherd should be furnished with large pockets or a well-lined basket, in which it must be placed till the ewe is brought to the shed. After the first day or two, the udders ought to be completely drained of their milk by the hand, so as to prevent swollen or caked bag. In case of deficiency of milk, the lamb may be supplied from a new-milch cow, by means of a sucking-bottle with an air vent, or it may draw a part of its nourishment from another ewe, which can be held while the lamb is sucking. It is sometime necessary to substitute a foster-mother, in which case, the ewe may be made to own the lamb, by milking from her udder over the lamb and under his tail, rubbing it on well; or rub the adopted lamb with the entrails and contents of the stomach of the dead lamb, or cover it with the skin. If the ewe proves a bad nurse, or it is desirable to bring the lambs forward rapidly, they may be early taught to eat boiled oats or other grain, cabbage, roots and tender hay. Lambs should be well fed, as it is important to produce size, constitution and perfection of form. The ewes and their young ought to be divided into small flocks, and have a frequent change of pasture. Some careful shephards adopt the plan of confining their lambs, and allow them to suck two or thee times a

day, by which they suffer no fatigue and thrive much faster. But this is troublesome and injurious, as the exercise is essential to the health and constitution of the lamb intended for rearing. It is admissible only when they are wanted for an early market, and by those who keep sheep for this purpose, it is a common practice.

Castrating and docking lambs—After selecting enough of the choicest rams for stock getters, the castrating may be performed at any time between two and six weeks old, when the lamb is in good health. A cool day should be chosen, or if warm, it must be done early in the morning. The best method is for one person to hold the lamb firmly between his legs, on an inclined plank upon which he rests, while another with a sharp knife, cuts off about two thirds of the lower part of the scrotum. The testicles are then drawn out till the spermatic cord is reached, which is divided by the thumb nail, or it is pulled out and cut with a sharp knife. It is sometimes done by simply opening the scrotum, when the testicles and spermatic cord are jerked out. The wound should then be rinsed with cold water, after which apply lard. The operation of docking, is by many deferred till a late period, from apprehension of too much loss of blood; but if the weather be favorable and the lamb in good condition, it may be performed at this time with the least trouble and without injury. The tail should be laid upon the plank, the person holding him in the same position as before. With one hand he draws the skin towards the body, while the other person with a two-inch chisel and mallet, strikes it off at a blow between the bone joints, leaving it one and a half to two inches long. The skin immediately slips back over the wound and is soon healed. Ewe lambs should be docked closer than the rams. To prevent flies and maggots, and assist in healing, it is well to apply an ointment composed of lard and tar, in the proportions of four pounds of the former to one quart of the latter. This is also a good application for the scrotum. The lambs should be carefully protected from cold and wet till they are perfectly well.

Tagging or clatting, is the removal of such wool as is liable to get fouled when the sheep are turned on to the fresh pastures, and of course it should be done just before leaving their winter quarters. It is most easily accomplished by placing the animal on a low table, and then holding it as in shearing, till the operation is performed. All the wool near the extremity of the sheath and the scrotum of the males,

from the udder of the ewes, and from the dock, and below it, the inside of the thighs and from the legs of the sheep, should be removed.

Summer Management.—As soon as the warm weather approaches and the grass appears, sheep become restive and impatient for the pasture. This instinct should be repressed till the ground has become thoroughly dry, and the grass has acquired substance. They ought moreover, to be provided for the change of food, by the daily use of roots for a few days before turning out. It would also check the tendency to excessive purging, which is induced by the first spring feed, if they were housed at night, and fed for the first few days, with a little sound, sweet hay. They must be provided with pure water, salt, &c. as in winter, for though they may sometimes do tolerably well without either, yet thrift and freedom from disease are cheaply secured by this slight attention. Dry, sweet pastures, and such as abound in aromatic and bitter plants, are best suited for sheep-walks. No animal with the exception of the goat, crops so great a variety of plants. They eat many which are rejected by the horse and the ox, and which are even essential to their own wants. In this respect, they are valuable assistants to the husbandman, as they feed greedily on wild mustard, burdocks, thistles, marsh-mallows, milk-weed and various other offending plants; and the Merino exceeds the more recent breeds in the variety of his selections. Many prepare artificial pastures for their flocks. This may be done with a number of plants. Winter rye or wheat sown early in the season, may be fed off in the fall without injury to the crop; and in the following spring the rye may be pastured till the stalks shoot up and begin to form a head. This affords an early and nutritious food. Corn may be sown broadcast or thickly in drills, and either fed off in the fields, or cut and carried to the sheep in their folds. An experiment made with white mustard for feeding sheep, is detailed on page 216, which shows it to be a valuable crop for this purpose. To give sheep sufficient variety, it would be better to divide their range into smaller ones, and change them as often at least, as once a week. They seek a favorite resting place, on a dry, elevated part of the field, which soon becomes soiled. By removing them from this for a few days, rains will cleanse, or the sun dry it, so as again to make it suitable for them. More sheep may be kept, and in better condition where this

practice is adopted than where they are confined to the same pasture.

WASHING SHEEP.—In most of that portion of the Union north of 40°, the washing is performed from the middle of May till the first of June, according to the season and climate. When the streams are *hard*, which frequently is the case in lime-stone regions, it is better to do this immediately after an abundant rain, by which the lime derived from the springs is proportionally lessened. The practice of a large majority of our farmers, is to drive their sheep to the washing ground, early in the morning of a warm day, leaving the lambs behind. The sheep are confined on the bank of the stream by a temporary enclosure, from which they are taken, and if not too heavy, are carried into water sufficiently deep to prevent their touching bottom. They are then washed by gently squeezing the fleece with the hands, after which they are led ashore, and as much of the water pressed out as possible before letting them go, as the great weight retained in the wool, frequently staggers and throws them down. A good practice is to lead the sheep into the water and saturate the fleece, after which they are taken ashore. When they commence *steaming*, they are again led into the water, and washed clean. This insures thorough cleansing where the water is pure. Others make use of a boat, one end of which rests on a bold shore and the other is in deep water. The operator stands in the boat and plunges the animal over the side where the washing is performed; or it is sometimes done by sinking a tight hogshead or large box in the water, with heavy weights, in which a man stands, and the sheep are brought or led to and from him by another person who walks on a platform reaching from the bank to the hogshead. Either of the last methods obviates the necessity of standing for a long time in water, by which colds, rheumatism, &c. are frequently contracted. In parts of Germany and sometimes in this country, sheep are forced to swim across a narrow stream several times, by which the fleece is tolerably cleaned, if all the water be pressed out when they get to the land. The yolk being a saponaceous compound, not an oily matter as is generally supposed, it readily combines with the water and passes out of the wool. An excellent practice when streams are not convenient, is to lead a small ripple of soft water into a tub. To this a little soap is added, after which the sheep are immersed and thoroughly cleansed. Perfect whiteness and

purity of the fleece is readily obtained afterwards, by throwing over the sheep a jet of water. This practice has a good effect, in preventing or removing cutaneous disorders and destroying ticks or other vermin. Many judicious farmers object to washing sheep, from its tendency to produce colds and catarrhal affections, to which sheep are particularly subject; but it cannot well be dispensed with, as the wool is always more saleable, and if carefully done, need not be attended with injury. Warm settled weather however, is indispensable to washing with safety to the general health of the sheep.

Shearing.—The manner of shearing varies with almost every district; but as this is an art to be acquired under a skilful master, we shall omit particular details on the subject. First clip all the tags and filth, if any remains or has been accumulated after the tagging in the spring; then take off the fleece and spread it with the outside uppermost on a smooth bench or table, and push the wool carefully together, to render it more compact; double the sides over to the centre; throw the clean loose locks into the middle, and roll together from each end. This makes a smooth, dense package, which is secured by passing a stout twine one or more times around the sides and ends. All the wool from the extremities should be closely sheared and saved by itself, before dismissing the the sheep, but never put up with choice fleeces. *If wounds are made*, which is sometimes the case with unskilful operators, a mixture of tar and grease ought to be applied. After shearing, such horns and hoofs as are likely to be troublesome, should be sawed and pared. The branding or marking is essential to distinguish them from other flocks, and this is done on the shoulder, side or buttock. A brush or marking iron is used for this purpose, with paint made of lamp black, to which a little spirits of turpentine is first added, and then diluted with linseed or lard oil. If the weather be cool, and especially if severe storms occur after washing or shearing, the flock should be housed. If sultry, they should have a cool, shady retreat, where they will be shielded from the flies and the heat. Blisters and permanent injury to the skin and fleece, are frequently the result of such exposure. Shade-trees in their pastures, contribute much to the comfort of sheep, when exposed to a blazing sun. A close examination of the skin, should be made at shearing, for the detection of disease or vermin. For remedies, see article *diseases*. Smearing or salving sheep, is a custom

little practised in this country. For cold, elevated and exposed situations, it may be necessary, and it is generally adopted in Scotland. The object is to prevent cutaneous diseases and vermin, and furnish additional warmth and protection to the fleeces of such breeds as are deficient in yolk. It is usually performed the latter part of October, but is sometimes done immediately after shearing. The mixture or salve consists of tar and butter or grease, in different proportions; 1 gall. of the former to 12, or sometimes 20 lbs. of the latter; the greater proportion of tar being required for the younger sheep, or for more exposed situations. The grease is melted over the fire, and the tar stirred in, and when sufficiently cool, it is applied to the whole body of the sheep, by carefully parting the wool and rubbing it on the skin with the fingers. The above quantity is sufficient for 30 or 50 sheep, according to their size and the character of the wool. This application is not required for fine-wooled sheep, whose fleeces are more appropriately protected by a natural secretion of yolk; and it is better to omit it in all cases, where the health and comfort of the animal do not render it absolutely essential. Mr. Stewart, an experienced Scotch shepherd, uses only tallow and train oil mixed in equal proportions. He asserts that the improvement in the growth and quality of the wool is at least one-third, and it materially benefits the condition of the sheep.

WEANING.—The lambs may be weaned from 3½ to 4 months old. They should be put upon rich, sweet feed, but not too luxuriant; while the dams are turned upon the poorest, and so remote from their young, as to be out of sight and hearing. The ewes ought to be carefully examined after a day or two, and if necessary, the milk removed with the hand. If it continues to accumulate, the ewe may be fed on hay for a few days. When thoroughly dried off, they should have the best fare to recover condition for subsequent breeding and wintering. The fall is a critical period to lose flesh, either for sheep or lambs; and if any are found deficient, they should be at once provided for by extra feed and attention. If cold weather overtakes them poor or in ill health, they will scarcely outlive it; or if by chance they survive, their emaciated carcass, impaired constitution, and scant fleece will illy repay the food and attention they will have cost.

The time for taking sheep from the pastures must depend on the state of the weather and food. Severe frosts destroy much of the nutriment in the grasses, and they soon after cease to afford adequate nourishment. Long exposure to cold storms upon such lands, with such food to sustain them, will rapidly reduce their condition. The only safe rule is to transfer them to their winter quarters the first day they cease to thrive abroad. *Drafting the flock* for the purpose of ridding it of the supernumeraries, should be done at an earlier day. Such of the wethers as have attained their prime, and those ewes that have passed it, ought to be withdrawn soon after shearing, and provided with the best feed, and rapidly fitted for the shambles. If they have been properly pushed on grass, they will be in good flesh by the time they are taken from it, and if not intended for stall-feeding, the sooner they are then disposed of the better. *Stall-feeding* will be lost on an ill-shaped, unthrifty beast. The perfection of form and health, and the uniform good condition which characterize the thrifty one, indicate too plainly to be misunderstood, those which will best repay the care of their owner. The selection of any indifferent animal for stall-fattening, will inevitably be attended with loss, and they had better be at once disposed of when first brought from the pasture, for the most they will bring.

MANAGEMENT OF SHEEP FOR THE PRAIRIES.—When destined for the prairies, they ought to commence the journey as early after shearing as possible. They are then disencumbered of their fleece, and do not catch and retain as much dust as when driven later. Feed is also generally better, and the roads are dry and hard. Young and healthy sheep should be selected, with early lambs; or if the latter are too young, and the distance great, they should be left and the ewes dried off. A large wagon ought to accompany the flock, to carry such as occasionally give out; or they may be disposed of whenever they become enfeebled. With good care, a hardy flock may be driven at the rate of 12 or 14 miles a day. Constant watchfulness is requisite to keep them healthy and in good plight. One half the expense of driving may be saved by the use of well-trained shepherd-dogs. When arrived at their destination, they must be thoroughly washed, to free them from all dirt, and closely examined as to any diseases they may have contracted, which if discovered, should be promptly removed. A variety of suitable food and good shelter must be provided, for the autumn, winter, and spring

ensuing, and every necessary attention given them. This would be necessary if indigenous to the country; how much more so, when they have just undergone a campaign, to which neither they nor their race have been accustomed.

Sheep cannot be kept on the prairies without much care, artificial food, and proper attention; and in a false system of economy, hitherto attempted by many, losses have occurred from disease and mortality in the flocks, sufficient to have made ample provision for the comfort and security of twice the number saved. More especially do they require proper food and attention, after the first severe frosts set in, which wither and kill the natural grasses. By nibbling at the *fog*, (the frost bitten, dead grass,) they are inevitably subject to constipation, which a bountiful supply of roots, sulphur, &c., are alone sufficient to remove. Roots, grain, and good hay; straw, or corn-stalks, pea or bean-vines, are essential to the preservation of their health and thrift during the winter, any where north of 40°. In summer, the natural herbage is sufficient to sustain them in fine condition, till they shall have acquired a denser population of animals, when it will be found necessary to stock their meadows with the best varieties of artificial grasses.

The prairies seem adapted to the usual varieties of sheep introduced into the United States; and of such are the flocks made up, according to the taste or judgment of the owners. Shepherd dogs are invaluable to the owners of flocks, both as preventives against the small prairie wolf, which prowls around the flock, but which are rapidly thinning off by the settlers; and also as assistants to the shepherds in driving and herding their flocks on the open ground.

DISEASES OF SHEEP.

The dry and healthful climate, the rolling surface, and the sweet and varied herbage which generally prevail in the United States, insure perfect health to an originally sound and well-selected flock, unless peculiarly exposed to disease. No country is better suited to sheep, than most of the northern and some of the southern parts of our own. In Europe, and especially in England, where the system of management is necessarily, in the highest degree artificial, consisting frequently in early and continued forcing the system, folding on wet, ploughed grounds, and the excessive use of that watery food, the Swedes turnip, there are numerous and fatal diseases. Hence the long list which lumbers the pages of foreign wri-

ters on sheep. The most destructive of these are the rot, and epidemics, which are scarcely known in America, except by report. The diseases incident to our flocks, may generally be considered as casualties, rather than as inbred, or necessarily arising from the quality of food, or from local causes. It may be safely asserted, that with a dry, rolling pasture, well stocked with varied and nutritious herbage, a clear, running stream, sufficient shade and protection against severe storms, a constant supply of salt, tar, and sulphur in summer; good hay, and sometimes roots, with ample shelters in winter; that young sheep, originally sound and healthy, will seldom or never get diseased on American soil. The few which it may be necessary here to mention, will be treated in the simplest manner. Remedies of general application, to be administered, often by the unskilful and ignorant, must neither be elaborate or complicated; and if expensive, the lives of most sheep would be dearly purchased by their application. A sheep which the owner has reared or purchased at the ordinary price, is the only domestic animal which can die without material loss to its owner. The wool and pelt will in most instances repay its cost, while the carcasses of other animals will be worthless except for manure. The loss of sheep from occasional disease, will leave the farmer's pocket in a very different condition, from the loss of an equal value in horses or cattle. Yet humanity equally with interest, dictate the use of such simple remedies for the removal of suffering and disease, as may be within reach.

Diarrhœa or scours, when light and not long continued, calls for no remedy. It is a healthful provision of nature, for the more rapid expulsion of some offending matter in the system, which if retained, might lead to disease. It is generally owing to improper food, as bad hay or noxious weeds; to a sudden change, as from dry food to fresh grass; or to an excess, as from overloading the stomach, and sometimes from cold and wet. *The remedies* are obvious; change to suitable food in the first two cases; abstinence after repletion, and warm, dry shelter with light diet in the last, are all that is necessary. When severe or long continued, a dose of castor oil may be given, and after its operation, give 4 grains opium and one ounce chalk, and put them on dry food. Wheat bran or shorts and oat-meal or flax-seed gruel, are good both for lambs and sheep; as are also ripe oats or wheat fed in the sheaf, with well cured, sweet hay, and plenty of salt. Fresh

boughs of the juniper or pine and hemlock, help to check the disorder.

Looseness in the larger lambs is prevented by having chalk within their reach, or if they refuse it, administer it in their food. When it happens soon after birth, place it with the ewe in a warm place, and feed the latter with plenty of oats or other sound grain. If the milk be deficient, give the lamb cow's milk scalded, or let it suck the cow. The tail is sometimes glued on to the buttocks while the scours continue. Separate it immediately by the use of warm water, and rub the parts with dry loam or clay.

DYSENTERY is a different and frequently a fatal disease, but resembles the former in its general symptoms. It is owing to prolonged diarrhœa, unwholesome or meagre food, and other causes. Bleeding and physic should be resorted to, after which give warm, nourishing gruel.

HOVEN.—*See hoven in cattle.*

BRAXY is manifested by uneasiness, loathing food, frequent drinking, carrying the head down, drawing the back up, swollen belly, feverish symptoms, and avoidance of the flock. It appears mostly in late autumn and spring, and may be induced by exposure to severe storms, plunging in water when hot, and especially by constipation brought on by feeding on frost-bitten, putrid or indigestible herbage. *Remedies* are not often succesful unless promptly applied. Bleed freely, and to effect this, in consequence of the stagnant state of the blood, immersion in a tub of hot water may be necessary. Then give two oz. Epsom salts, dissolved in warm water, with a handful of common salt. If this is unsuccessful, give a clyster made with a pipe-full of tobacco, boiled for a few minutes in a pint of water. Administer half, and if unsuccessful, follow with the remainder. Then bed the animal in dry straw and cover with blankets, and assist the purgatives with warm gruels, followed by laxitive provender till well.—(*Blacklock.*) Thousands of sheep have died on the prairies from braxy, induced by exposure and miserable forage. Perfect preventive is secured by warm, dry shelters, and nutritious, digestible food.

COSTIVENESS is removed by giving two table spoonsful of castor oil every 15 hours, till the difficulty is removed; or give one oz. Epsom salts. This may be assisted by an injection of warm, weak suds and molasses.

STRETCHES.—Sheep sometimes stretch out their noses on the ground and around their sides as if in severe pain. This

may be caused by an involution of one part of the intestine within another. When owing to this cause, the difficulty is frequently removed, by jerking the animal by the hind legs several times, when the pain disappears. But it is generally occasioned by costiveness, which see above. This may be prevented by using green food, roots, &c., once a week, or by allowing them to browse on the evergreens, pines, &c.

POISON from laurel and other plants, is cured by pouring a gill of melted lard down the throat, or boil for an hour the twigs of the white ash, and give a ½ to 1 gill of the strong liquor immediately; to be repeated if not successful.

INFLAMMATION OF THE LUNGS is produced by improper exposure to cold and wet. The remedy for slight affecions, is warm, dry shelter, and light food. When severe, resort must be had to bleeding and purging freely, then to light bran or linseed mashes.

ROT sometimes causes the death of a million of sheep in a single year in England, yet it is a disease almost unknown in this country. Foreign authorities ascribe it entirely to excessive humidity of climate, wet pastures, or too watery food. The preventives are therefore obvious. After the use of dry food and dry bedding, one of the best is the abundant use of pure salt. In violent attacks, early bleeding, followed by a dose of 2 oz. Epsom salts, to be repeated if necessary, with a change of diet and location, is all that can be done.

FOOT-ROT is frequently a prevalent disease among American sheep. It is sometimes spontaneous, but more often produced by contagion. In the former case, it is caused by soft, rich, or moist pastures. A dry gravelly or rocky range, will of course be an effectual preventive when owing to this cause. Contagion is communicated, by the absorbents of the foot coming in contact with the suppuration, which has been left on the ground from the diseased part. Absolute safety against this contagion is secured, only by a a total avoidance of the walks of the infected animals, till repeated rains, or what is better, frosts have disarmed the virus of its malignity. *Remedies* are variously compounded, of blue vitriol, verdigris, tar, spirits of turpentine, alum, saltpetre, salt, lime, copperas, white lead, antimony, alcohol, urine vinegar, &c., all of which are effectual. The hoof should first be pared and thoroughly scraped. Then apply a wash made of three parts of blue vitriol, one of verdigris pulverised finely, with scalding (not boiling) vinegar; stirring briskly till it is of the consistence of thin cream, and put it upon the

affected part with a paint brush. It is a good preventive, to apply this to the sound feet of the affected animal. Another remedy is to use spirits of turpentine after scraping; and if the disease is of long standing, add to the turpetine a strong decoction of blue vitriol dissolved in water. The foot should be examined every week, and the remedy repeated till perfect soundness is restored. A feather dipped in muriatic or nitric acid and applied to the parts after scraping and cleansing, is a good remedy. When put upon the soles of *foot-sore* sheep, it hardens the hoofs and enables them to travel better. Sheep are sometimes cured by keeping them on a dry surface, and driving over a barn floor daily, which is well covered with quick lime. It may also be cured by dryness and repeated washing with soap-suds. The above ailment should not be confounded with a temporary soreness or inflammation of the hoof, occasioned by the irritation from the long rough grasses which abound in low situations, which is removed with the cause; or if it continues, apply white paint or tar, after thorough washing.

Corrosion of the flesh by flies or maggots, may be cured by first removing the vermin, then wash with Castile soap and warm soft water, after which apply white lead with linseed oil. Tar put on the festering wound corrodes it; but this, or spirits of turpentine placed on the sound parts near it, keep off the flies by their strong effluvia. If the wound be slight and the weather moderate, apply a little spirits of turpentine with a strong decoction of elder bark. *Flies on sheep* may be prevented by smearing with a composition made of two lbs. lard or soft grease, one lb. sulphur, ½ pint oil of amber, or oil of tar, or tar alone. A small spoonful is sufficient for a sheep.—(*Genesee Farmer, vol.* 7.)

Protection from the gad-fly.—In July, August, and September, in the northern states, the *gad-fly* (*Œstus Ovis*) attacks the nostrils of the sheep, and there deposits its eggs, which on being hatched, immediately crawl up and make a lodgment in the head. They are frequently repelled, by laying a thick coat of tar on the bottom of the troughs, and sprinkling it with salt. The smell of the tar adhering to the nose, will drive off the fly. A more effectual remedy is to apply it thoroughly with a brush to the external part of the nose. If a few furrows of loose earth are turned up in their pastures, the sheep will hold their noses to them and thus keep off the fly. The symptoms of grubs in the head, are drooping of the head and ears, discharge of bloody and

watery matter from the nostrils, and loss of strength in limbs. If worms have made a lodgment, take ½ lb. of good Scotch snuff, add 2 quarts boiling water, stir and let it stand till cold. Inject about a table spoonful of this liquid and sediment up each nostril with a syringe. Repeat this three or four times at intervals, from the middle of October till January; the grubs are then small and will not have injured the sheep. The efficacy of the snuff will be increased, by adding ½ an oz. asafœtida, pounded in a little water. The effect on the sheep, is immediate prostration and apparent death, but they will soon recover. A decoction of tobacco will afford a substitute for snuff.—(*N. England Farmer.*) Blacklock's remedy is to half fill the bowl of a pipe with tobacco, light it and then hold the sheep, while a person inserts the stem some distance into the nostrils, and blows a few whifs into the nose. The operation is then repeated with the other nostril.

Swollen mouth is sometimes fatal. It is said to be cured by daubing the lips and mouth plentifully with tar.—(*Albany Cultivator, vol.* 7.)

Foul Noses.—Dip a small swab into tar, then roll in salt. Put some on the nose and compel the sheep to swallow a small quantity.—(*American Farmer.*)

A disease indicated by drooping, running at the eyes, weakness in the back and loins, inability to use the hind legs, was removed by turning the sheep into a pasture containing Lobelia (*Indian tobacco*). Dried lobelia was also given, and produced the same effect.—(*Cultivator, vol.* 2.)

Scab.—This loathsome disease, to which fine-wooled sheep are particularly liable, is caused, like itch in the human subject, by a small insect, a species of the *acari.* It is first manifest by the rubbing of the sheep, and soon after by one or more tufts of wool, which is loosened at the roots. On feeling the skin, a hard dry tumor is perceptible. To prevent contagion, remove the infected sheep to a separate pasture or yard as soon as discovered. The Spanish shepherds disolve a little salt in their mouth and drop it upon the infected part. When the tumor has become enlarged, the wool should be removed closely to the skin, the scab scraped with a curry-comb, then wash with strong soap-suds or ley, and afterwards rub thoroughly with sulphur or brimstone, mixed with lard or grease. An effectual remedy is prepared by taking one pound of tobacco which add to 12 qts. ley from wood ashes, of sufficient strength for washing, and four quarts urine; to this add another mixture of a gill high-wines, ¼ oz.

camphor, ½ oz. Spanish brown, and ½ gill spirits of turpentine. A small quantity of this applied to the sore, will never fail. Immediately after shearing, scab may readily be cured by immersing the sheep, (excepting the head,) in a strong decoction of tobacco liquor, adding a gill of spirits of turpentine for the first, and making a slight addition of fresh liquid for each sheep immersed, enough to keep up the strength of the tobacco and, turpentine, and taking care to rub the affected part thoroughly. For lambs, this liquor should be diluted, but yet left strong enough to kill ticks in one or two minutes, which may be ascertained by experiment. *For killing ticks* this last is a good remedy. After dipping the sheep or lambs, the liquor should be pressed out from the wool, upon an inclined plane, so arranged as again to run into the vessel. Scab is also removed by using a composition of one pound plug tobacco to three gallons water, with lime-water and oil of vitriol added or a decoction of hellebore with vinegar, sulphur and spirits of turpentine.—(*H. D. Grove.*) Scab is propagated more by using the same rubbing posts, than by contact with each other. Sheep in low condition are more subject to it than others.

Ticks and lice sometimes infest sheep. Good feeding and shelter is a partial preventive, but when they have made their lodgement, they mnst be dipped in a decoction of tobacco water. The most effectual time for their destruction, is a few days after shearing, when they will have left the naked bodies of the old ewes to hide in the fleeces of the lambs. The dipping in tobacco water is an effectual remedy.

PELT-ROT will be recognized as one of the staple diseases of our *native sheep*, described on page 322. The wool in this case falls off, leaving the sheep partially or almost wholly naked; but it is not accompanied with soreness or apparent disease. The animal must be provided with a warm stall and generous feed, and the naked skin should be anointed with tar and grease. The preventive is good keeping and shelter.

STAGGERS OR STURDY, AND WATER IN THE HEAD, sometimes affect sheep, but more especially lambs under a year old. The first is caused by the hydatid. It is considered as an almost incurable disorder, but is sometimes removed by trepanning. Chancellor Livingston carefully supplied two thus attacked, with food for three months, when nature effected a cure. Removal to dry lands and purging, is a good precaution when they are first taken. An English lad lately cured one which had been given up, by boring with a gimblet into the soft place on the head, when the water rushed out

and the sheep immediately followed the others to the pasture. A correspondent of the Albany Cultivator asserts, that ½ a pint of melted lard poured down the throat, will cure blind staggers in 10 minutes.

ABORTION occurs sometimes, and is usually caused by excessive fright or exertion, and sometimes by severe exposure and poor feed. It is seldom fatal, except to the lamb. *The uterus* is occasionally protruded after lambing. It should be immediately returned, first washing it in warm milk and water, if any dirt adheres to it. For this, the hand only should be used. After rubbing it with lard or oil, hold up the hind legs, and gently replace the protruded parts, then keep the ewe quiet till fully recovered.

FOR GARGET, OR CAKED BAG.—Keep the bag thoroughly drained of milk, for which purpose the lamb is the most efficient. If it is lost, another may be temporarily substituted. Purge freely with Epsom salts, and wash the udder repeatedly with very warm water. If matter forms, it should be opened with the lancet.

BLEEDING.—"Nothing tends so much to the recovery of an animal from a disease in which bleeding is required, as the rapid flow of the blood from a large orifice. Little *impression* can be make on an acute disease by the slow removal of even a large quantity of blood, as the organs have time to accommodate themselves to the loss, which might, for any good it will do, as well be dispensed with. Either bleed rapidly or not at all. The nearer the commencement of an ailment, in which you employ bleeding, the operation is resorted to, the greater the chance of its doing good. Bleeding by nicking the under surface of the tail, does very well where no great deal of blood is required, but it is not to be thought of if the veins of the face or neck can possibly be opened. These are to be taken in preference to a vein on the leg, as they are much more readily got at. The facial vein commences by small branches on the side of the face, and runs downwards and backwards to the base of the jaw, where it may be felt within two inches of the angle, or opposite the middle grinding tooth. It is here that the orifice must be made; the thumb of the left hand being held against the vein, so as to prevent the flow of blood towards the heart will make it *rise*. Some prefer opening the jugular vein, which commences behind the eye and runs down the side of the neck. This vessel is, however, more difficult to open that the former, being better

covered with wool, and not so easily exposed or made to swell. *Stringing* is the mode commonly resorted to for this end; that is to say, a cord is drawn tightly round the neck close to the shoulder, so as to stop the circulation through the vein, and render it perceptible to the finger. A lancet is the instrument generally used in bleeding, though a well-pointed penknife will do at a pinch. The opening must always be made obliquely; but before attempting this, the animal must be secured, by placing it between the operator's legs, with its croup against a wall. The selected vein is then fixed by the fingers of the operator's left hand, so as to prevent its rolling or slipping before the lancet. Having fairly entered the vein, the point of the instrument must be elevated at the same time that it is pushed a little forward, by which motion it will be lifted from or cut its way out of the vein. *A prescribed quantity of blood should never be drawn*, for the simple reason that this can never be precisely stated. If the symptoms are urgent, as in all likelihood they will, your best plan is not to stop the flow of blood till the animal fall or is about to fall. When this occurs, run a pin through the edges of the orifice, and finish by twisting round it a lock of wool."—(*Blacklock.*)

LARGE CUTS ARE HEALED by first sewing and then covering with salve. Smaller ones may be secured with an adhesive plaster or bandage.

TO PROTECT LAMBS FROM WOLVES AND FOXES, smear the neck plentifully with a mixture of tar and sulphur. Bells are also said to guard them, as both are excessively wary, and have a great dislike to any thing artificial. Large dogs will keep them at bay. A better remedy is to kill the marauders, which may be done by inserting strychnine in fresh meat and leaving it in their haunts.

SHEPHERD DOGS.

Of these there are two widely distinct breeds. One embraces the large Spanish dog and their descendants, the Mexican, and some other varieties, which are of a size, strength and courage sufficient to defend the flock against wolves, or other formidable enemies. They are frequently inclined to be ferocious, and will sometimes commit depredations on the flocks themselves. They are only necessary where there is danger from wild beasts and prowling dogs, against which, if thoroughly trained, they are always an efficient protection. The smaller kind is invalua-

ble for assisting the shepherd in bringing in his sheep, keeping them within any required compass, driving them from place to place and giving signal of danger. There are numerous sub-varieties, of different sizes; some with long tails, others without any; some smooth-haired, but more generally shaggy or long-haired. Each of these have a natural instinct for the management of sheep, and, if properly educated, will seldom fail to answer every reasonable wish of their masters. Unless sheep are confined in small pastures, and are so familiar and manageable as to come readily at call, the use of the sheep-dog will save much of the shepherd's time. He has the intelligence of a man in comprehending the wants of the shepherd, and is vastly more efficient in bringing them together, or driving on the road and keeping them separate from other flocks. Sheep soon get accustomed to them, and without being alarmed by their presence, they learn to regard them as guides, whom they must implicitly obey. All the above varieties have been imported, and the smaller ones are now extensively bred in this country.

CHAPTER XVIII.

THE HORSE.

In nearly all ages and countries, the horse has been the devoted servant, and the object of the pride and affection of man. Among the semi-civilized Tartars of middle and northern Asia, the Aborigines of our remote western prairies, reaching even beyond the Rocky Mountains, and some other rude nations, his flesh is used for food. Many tribes among the former, use the milk for domestic purposes, and especially when fermented and changed to an unpleasantly sour and intoxicating beverage. But throughout the civilized world, with some slight exceptions, the horse is useful only for his labor. For this purpose he is pre-eminently fitted by his compact, closely knit frame; his sinewy, muscular limbs; his easy, rapid stride; his general form and entire structure and habits. He is found in his wild condition in central Asia, Siberia, and the interior of Africa, and for 300 years he has been turned loose to follow his native instincts on the illimitable pampas of South America, and the wide-spread prairies of Mexico and California. In all these regions he closely resembles the medium varieties of the domesticated horse, but as the natural result of his freedom, he possesses more fire and spirit than any other, except the blood horse.

Arabia is generally claimed as the original native locality of the horse, and as the only source from which he is to be derived in the requisite perfection for the highest improvement of the race. But Strabo, who wrote more than 1800 years ago, asserts that the horse did not then flourish in Arabia, and it was not till some centuries later, that he attained any decided superiority there. Great attention, however, has been paid in that country, since the era of Mahomet, to the possession of a light, agile and enduring frame, intelligence and tractability of character, and the

perpetuation of these qualities, by the most scrupulous regard for the purity of blood. This is equally true of the Barb or pure-bred horse of Morocco, and those of the northern coast of Africa, in Egypt, among the Turks, and indeed wherever the followers of the Prophet are to be found. It is unquestionable that the influence of the eastern blood among the choicest animals of modern Europe, has been followed by great improvements in racing stock. Yet it is equally certain, that the race horse, both of England and the United States, has acccomplished what has never been demonstrated as within the ability of their progenitors; and on repeated trials with the eastern horses, he has shown himself confessedly their superior in speed, strength and endurance. In 1825, two English horses ran against the two fleetest Cossacks which could be found throughout the entire region of their best blood, and in a continued race of 47 miles, the European took the stakes, Sharper, the most successful, performing the distance in 2 hours and 48 miuutes. About the same time, Recruit, an English horse of moderate reputation, easily beat Pyramus, the best Arabian on the Bengal side of India. The Leeds, the Darley and the Godolphin Arabian; the Lister and D'Arcey's White Turk, and other noted eastern horses, would not compare in performance with many of their descendants. But these, with some other choice Arabians, on the best mares, and with every advantage for obtaining celebrity, have succeeded in establishing a fame as just as it has been enduring. Yet it must at the same time be remembered, that of the innumerable other pure-bred horses which have been tried in Europe, a few only have rescued their names from oblivion.

The experience of eastern blood in this country, in comparison with the best English, is decidedly in favor of the latter. We have had one horse of unsurpassed excellence, which a fortunate accident threw upon our shores a short time previous to 1770. This was the white Barb *Ranger*, which was presented by the Emperor of Morocco as the choice of his stud, to an English naval officer for some distinguished service. On his route homeward, the animal was set on shore for exercise at an intermediate port, where in his gambols he broke three of his legs, and thinking him worthless, his owner gave him to the commander of a New England merchantman, then present. He was readily accepted, and placed in slings on board of his vessel, and recovered. This animal stood for many years in the eastern part of

Connecticut, and on their good mares, produced a numerous progeny of unrivalled cavalry horses, which rendered invaluable services in the troop commanded by that consummate partisan, Captain (afterwards General) Lee, of the revolution. It is said the favorite white field-horse of General Washington, was of the same stock. He was afterwards sold to Captain Lindsey, as a special favor, and taken to Virginia, where he produced some good racers. Bussorah, a small sorrel horse, brought into this country from the head of the Persian Gulf, in 1819, then 5 years old, got many choice roadsters, though few, if any racers. The Narraganset pacers, a race belonging to our eastern states, but for many years almost extinct, possessed for a long time an unrivalled reputation for spirit, endurance and easy, rapid motion under the saddle; and they are said to have originated from a Spanish horse, many of which are pure descendants of the Barb. As an offset to these isolated examples of success in this country, we have numerous instances of the importation of the best Orientals, which have been extensively used on some of our superior mares, without any marked effect. We shall refer to three prominent importations only. The first consisted of two choice Arabians, or Barbs, selected in Tunis by General Eaton, and sent to his estate in Massachusetts. The second was a present of four choice Barbs from the Emperor of Morocco to our government, in 1830; and the third consisted of two Arabians, sent by the Imaum of Muscat, near the Persian Gulf, to our government in 1839 or '40. These were all claimed to be, and no doubt were, of the pure Kochlani, the unadulterated line royal; yet none have earned any distinguished reputation.

It is to England we are mainly indebted for the great improvement in our blood, road and farm horses. A numerous race of fine horses were reared on that Island, long previous to any authentic history of it; for in his first invasion, Julius Cæsar took many of them to Rome, where they immediately became great favorites, although this mistress of half the known world, had already plundered every region of some of their best breeds. What might have been the particular merit of the English horse at the time of the Norman invasion, is not known, but it is certain that the Saxon cavalry under Harold, were speedily over-powered by William, at the battle of Hastings, which at once secured the throne to the Conqueror. History first informs us of the improvement of British horses, by importations from abroad during this reign,

which consisted of a number of Spanish stallions. These were supposed to be strongly imbued with the Arabian blood, which had been brought over to that country by the Moors, who had founded the Saracenic empire in the Peninsula, three centuries before. More than a century later, John made some importations from Flanders, to give weight and substance to their draught and cavalry horses. The improvement of their various breeds, was afterwards pursued with more or less judgement and zeal, by other British monarchs, till they reached their highest excellence during the middle of the last century. Flying Childers, Eclipse, Highflyer, and others on the course, have probably exceeded in speed anything ever before accomplished; while the draught-horse, the roadster, the hackney, the cavalry horse and the hunter, attained a merit at that time, which some judicious authorities claim, has not been since increased. It is even asserted, that some of the more serviceable breeds, have been seriously injured by too great an infusion of the blood; while the almost universal absence of long heats on the turf, has tended to the improvement of speed, rather than bottom in the race horse.

The improvement of the horse in this country, has not been a matter of record or history, till within a comparatively recent period. But it has silently, and with no little rapidity been going forward, for more than a century, till we have obtained a race of animals, throughout the eastern and middle states at least, which probably equal those of any other country for adaptedness to draught, the road and the saddle. This improvement has been mainly brought about, by the importation of some of the *best and stoutest of the English blood.* In breeding from these for purposes of utility, particular reference has been paid to strength, enduringness and speed. No horses surpass our best four-mile bloods; none equal our trotters; and though much inequality exists in those bred for our various other uses, yet for profitable service, it is believed, no equal number of animals elsewhere, can exceed those in the region above indicated. It would be a superfluous task to attempt enumerating all the imported horses that have contributed to this improvement. Each good animal has done something. But among the earlier horses which may be named with distinction, as having effected much for our useful beasts, are Lath, Wildair, Slender, Sour-krout, Tally-ho, Figure, Bay Richmond, Expedition, Baronet, and a host of others. Pre-eminent among these, was imported Messenger. He was

foaled in 1780, imported in 1788, and died in 1808. He stood in different places in New-Jersey; and in Dutchess, Westchester and Queens counties in New-York; and upon the mares derived from the foregoing and other good horses, he got a numerous progeny of illustrious descendants. Of these, we may name those capital stallions, Potomac, Hamlintonian, Bay Figure, Engineer, Manbrino, Tippoo Saib, Columbus, Gunn's, and Bushe's Messenger, and many others, which were extensively disseminated over the northern and middle states; and he has the credit of imparting a large share of his merits to his grandson, that nonpareil of horses, American Eclipse. His posterity were so numerous and widely spread, that it may be safely asserted that of the best horses bred in the above states, scarcely one can now be found, which does not trace one or more crosses to his distinguished sire. His success in producing roadsters, besides his blood qualities of speed and endurance, consisted in his great strength and the peculiar formation of his limbs, large fore-hand and deep quarters, in which he excelled any other of the imported bloods.

As an illustration of what may be accomplished by judicious breeding with the present materials in our hands, we mention one family of the American roadster, which is strongly tinctured with blood, and which has attained an enviable notariety among the choicest of the northern horses. They are derived from the *Morgan horse* of Vermont, that was foaled in Springfield, Mass., in 1793. He was got by True Britton, supposed to have been bred by Gen. Delancey of New-York, and got by imported Wildair, (or one of his sons,) a horse of such distinguished excellence, as to have been re-exported to England, for the benefit of his stock. The Morgan horse stood in Vermont from 1795, till his death, at an advanced age. From him and the choice mares of Vermont, descended many excellent colts; and his merits were inherited in an eminent degree by three of his sons, which stood in the same state and continued the career of improvement commenced by the sire. The result has been the production of a family of roadsters, of much similarity of appearance* and uniformity of character, unsurpassed by any others for serviceable qualities. They are of medium size, from 13½ to 15 hands high;

* Many of the Morgan horses have the steep rump and heavy breast and neck, which indicates a Norman cross on the side of their dams, which has been largely imported through the French horse in the adjoining Canadian settlements; but none of these are said to have characterised the founder of the race.

with a well-formed head and neck; high withers; deep chest; round body; short back; long quarters; broad flat legs; moderately small feet; long wavy mane and tail; presenting altogether the beau ideal of the road horse. They are spirited, docile, hardy and easily kept. They have an easy, rapid trot, and glide along with a good load, without clatter or apparent effort, at the rate of 10 or 12 miles an hour. This family of horses has not of course been bred long enough within themselves, to have attained to the eminence of a distinct breed. They are mentioned, merely as a type of what the serviceable roadster ought to be, and what he may become by the use of the proper instrument for breeding. And if the materials already in our hands are intelligently and perseveringly used, we can produce all we require of horse-flesh.

Besides our unsurpassed blood-horses, we have others derived from various sources, and especially from the different English breeds, all of which are variously compounded, with the first and with each other. On our north-eastern frontier, the *Canadian* prevails, a bastard but not degenerate race, made up of the French Norman and the English or American. At the extreme south and west, we have the *horse of Spanish origin*, obtained in his domestic state in Florida and Louisiana; and from another branch of the Spanish, are desended the wild horses of Mexico and the more northern prairies. These are diversified in character, and generally possess medium size and merit. The *Conestoga*, a heavy roadster, is principally reared in Pennsylvania, and is used for the team and truck. He is an amalgamation of several breeds, but probably owes a share of his character to the Flemish horse, for which there was a decided partiality among the numerous German emigrants of that state. Several varieties of *ponies* are to be found in different sections, but principally among the French, the half-breed and the Indians upon the frontiers, who have bred a stunted race from the Canadian or wild horse, and such others as could survive the hard usage and the scanty winter food, afforded by nature and their rude husbandry. Many of these have considerable beauty and symmetry, and are fleet, hardy and spirited. The *modern Norman*, or mixture of the old French Norman draught-horse, (heavy-framed, big-limbed but stout and hardy,) and the Andalusian, a descendant of the Moorish barbs, has been introduced within a few years, and will unquestionably become a very popular horse for many purposes. He exhibits the qualities

of both ancestry in the proper proportions for farm service. He has a thick head; lively, prick ears; short, heavy neck; large breast and shoulder; strong limbs; well-knit back; large quarters with much wavy mane, tail and fetlock. Like his French progenitor, he frequently stands low in the withers, which enables him to throw great weight into the collar; and the diminished, flattened leg, the wind and game derived from his Moorish blood, give him much of the capacity and endurance of the thorough-bred. The *English cart-horse* has for a long time made up some of the best, heavy dray horses in the country, and late importations have refreshed the breed with additional choice specimens. The *Cleveland bay* has been introduced of late, and promises good carriage horses from our well-spread, sizeable mares. The *Norfolk trotter, Bellfounder*, was imported many years since, and with our high-bred mares, has produced many choice roadsters and trotters.

The remainder of our horse-flesh deserving of any notice, is chiefly composed of such as are superior in point of blood and merit. The improvement in the American horse, is conspicuous and decided. Judicious breeders still look for qualities in the descendants, which they sought for in their imported sires, and the infusion of some of the stoutest of the blood is rapidly gaining on ascendancy in the general stock; and we are confident our intelligent agriculturists will not permit this to proceed to an extent, that may be prejudicial to their value as draught horses, as has been done in some portions of England and our Southern states. There is no danger from excess of blood if it be of the right kind; but it is seldom found combining that fulness and stoutness, and that docility and tractableness of disposition, which are essential to the gig horse or the horse of all work. Yorke says truly, that "the road horse may possess different degrees of blood, according to the nature of the country and the work required of him, [he might have added with propriety, *and according to the character of the blood.*] His legs will be too slender; his feet too small; his stride too long, and he will rarely be able to trot. Three parts or half, and for the horse of all work, even less than that, will make a good and useful animal." For the saddle only, the high-bred is never objectionable to an enterprising and accomplished rider, if not diposed to be vicious. His long elastic pasterns, giving easy, flexible motions; his quick and almost electrical obedience when under thorough discipline; his habitual canter and high spirit, always commend him for this purpose.

Some of the prominent external points of a fine saddle or gig horse are, a moderately small head, free from fleshiness; fine muzzle and expansive nostrils; broad at the throat and wide between the eyes, which denotes intelligence and courage; a dished face indicates high breeding, and sometimes, viciousness; a convex or Roman nose frequently betokens the reverse; the ears rather long, yet so finely formed as to appear small, and playing quickly like those of a deer; and the eyes clear, full, and confident, with a steady forward look. Glancing them backward or askance with a sinister expression, and with none or only a slight movement of the head, is indicative of a mischievous temper. The neck should be handsomely arched, and fine at the junction with the head, while the lower extremity must be full and muscular, and well expanded at the breast and shoulders. The latter ought to be high and run well back; the withers strong, firmly knit and smooth; the breast neither too prominent or retreating, too wide or too narrow, and supported by a pair of straight fore-legs, standing well apart. The chest should be deep, and the girth large; the body full, and not drawn up too much in the flank; the back short, and the hips gathered well towards the withers; the loins wide and rising above the spine; the ribs springing nearly at right angles from the back, giving roundness to the body. The hips ought to be long to the root of the tail, and the latter may approach to near the line of the back, which is a mark of good breeding. Both the thigh and hock should be large and muscular; and between the hock or knee and pastern, the legs should be broad, flat, and short; the hind legs properly bent, and all well placed under the body; the pasterns of moderate length, and standing slightly oblique; the hoof hard, smooth, round before, and wide at the heel; the frog large and sound; and the sole firm and concave. A white hoof is generally tender, easy to fracture and to lame, and difficult to hold a shoe. The *draught-horse* ought to differ from the foregoing, in possessing a heavier and shorter neck, a wider and stouter breast and low withers, so as to throw the utmost weight into the collar; a heavier body and quarters, larger legs and feet, and more upright shoulders and pasterns.

Considerations which affect the value of the horse.—The color is not material, provided it be not pied or mealy. No better color for horses can be found than the dark bay or brown, with black mane, tail and legs. But most of the other colors

are frequently found with the best horses. Hard-mouthed horses, when accompanied with great spirits, are objectionable, as they require peculiar bitting and the utmost vigilance. The paces and action of a horse are important, for if good, they give a much greater capacity for performance. Some of these depend on form and structure, and are unchangable; others are the result of breaking. All horses should be taught to walk fast, as it is their easiest and most economical pace, and it will help them over a great deal of ground in a day, even with a heavy load, and with comparatively little effort. A horse that steps short and digs his toes into the ground, is worthless as a traveller, and suited only to a ferry boat or bark mill. It is important that a horse be good tempered. If inclined to viciousness, he should be gently yet firmly managed when it is first apparent. A resort to great severity will be justified, if necessary to conquer him; for if once allowed to become a habit, it will be difficult to cure him. Grooms and mischievous stable-boys frequently do much injury by their idle tricks with horses, and when detected, they should be discharged at once. Some horses are nervous, easily excited, and start at every unusual noise or object. Others are restive and fretful and ever anxious to be on the move. Kindness and firm, yet mild treatment, by which their motions and will are at all times controlled, and their confidence secured, are the only remedies. Others are inclined to sluggishness. These should have stimulating food, and never be overloaded or overworked, and then kept well to their paces. Whatever they are capable of performing, can in this way only be got from them. Habit has great influence with animals, as with man; and when within the compass of his ability, he may be habituated to any reasonable physical exertion.

Breeding.—Agreeably to the general principles before enumerated, such animals should be selected as most eminently possess those points which it is desired to propagate, and these they should not only exhibit in themselves, but should inherit as far as possible from a long line of ancestry. For the perpetuation of particular points in progeny, it would be safer to rely on the latter quality than the former. The selection of a mare, relatively larger than the horse, is an important rule in breeding, and it is believed that much of the success of Arabian and other Eastern horses as stock-getters, has resulted from the application of this principle. They possess valuable traits, but condensed within

too small a compass. When such an animal is put to a well-bred, larger mare, the fœtus has abundance of room and nourishment to develop and perfect the circumscribed outlines of the male parent, and acquire for itself increased volume and character. The horse ought not to be less than four or five, and the mare one year older before being put to breeding. It would be still better to defer it for two or three years, or till the frame is fully matured.

The gestation of the mare sometimes varies from 44 to 56 weeks, but she usually goes with young from 47 to 50; and it is advisable she should take the horse at a time, which will ensure the foaling when the weather is settled, and there is a fresh growth of grass. She will be the better for light working till near the time of foaling, if well, but not too abundantly fed. In a few days after this, she may resume moderate labor; and if not in the way or troublesome, the foal may run with her; but if she is exposed to heating, it should be confined till she cools, as suckling them is decidedly injurious to it. The mare is in danger of slinking her foal from blows and over exertion, the use of smutty grain, foul hay, or offensive objects or smell; and when this has once occurred, which happens usually in the fourth or fifth month, she should afterwards be generously fed at that period, and only moderately worked. When liable to slinking, the mare should be removed from others in foal, lest a peculiar sympathy should excite an epidemic. The mare comes in heat from nine to eleven days after foaling, when she should be put to the horse, if it be desirable to have a colt the following season. She comes round at intervals of about nine days each.

Management of the colt.—The colt may be weaned when five to seven months old, and preparatory to this, while with the mare, may be taught to feed on fine hay, meal or oats. When taken away, he should be confined beyond a hearing distance of the dam, and plentifully supplied with rowen or aftermath hay, mashed or ground oats, or wheat shorts. It is economy to provide a warm shelter through the inclement season for all animals, and especially for colts, which with all other young, should have an abundance of nutritious food. They will thus grow evenly and rapidly, and attain a size and stamina at two years old, they would not otherwise have acquired at three.

Castrating.—The colt should be altered at about one year, but if thin in the neck and light before, the operation may

be deferred to such time as these requisite developments are secured. Few of the French diligence and farm horses, and scarcely any of the Oriental, are ever castrated. They are thought to be more hardy and enduring; but the slight advantage they may possibly possess in this respect, would illy compensate for the trouble and inconvenience arising from their management. The operation should be performed late in the spring or early in autumn, while the weather is mild. If in high condition, the animal must first be bled and physiced. If large and fractious, he must be cast. Some back him into the angle of a worm fence, where he is firmly held by the head with a bridle, and the operator accomplishes the object, without any trouble or material restiveness from the animal while standing. The scrotum should be opened on both sides and the testicles cut, or rather the cord scraped off, which prevents as much bleeding. The wound may be dressed with a little lard ; then turn him loose in a pasture which has a shelter from sun, wind or rain. Another method of castrating is by *torsion* or twisting. *Docking* is practised by many, but merely to gratify an absurd and cruel caprice, without a single advantage, and the animal is better in every respect with the tail unmutilated. If done at all, it should be when young, and with a single stroke of the knife, or chisel and mallet; and if the weather be favorable, no further attention is necessary. *Nicking.*—This inhuman custom is now getting unfashionable, and we omit any description of it.

Breaking —While feeding in the stable, the colt should be gently treated, and accustomed to the halter and bit, which prepares him for breaking. If permitted to run with the others while at work, he becomes familiarized to it, and when harnessed by the side of some of his well-trained mates, he considers his discipline rather a privilege than a task. The colt may be taken in hand for breaking at three, and thoroughly broken to light work at four, but should not be put to hard service till six or eight. A due regard to humanity and sound judgment, in thus limiting the burthen in his early years, would save much disease and suffering to the animal and profit the owner, by his unimpaired strength and prolonged life. The annual loss from neglecting this precaution is enormous, which might be entirely avoided, by less eagerness to grasp the substance, while as yet the shadow only is within reach. Many animals are thus broken down at twelve, and are in their dotage at fifteen, while others of

good constitution, if well treated, perform hard service till thirty.

Longevity of the horse.—Mr. Percival mentions one that died at 62. Mr. Mauran of New-York, has a fine gig and saddle horse, now in his 45th year, sound, spirited and playful as a kitten. He is of a dark brown with a tanned nose. We never yet saw a horse with a buff or bear muzzle, that had not great endurance. American Eclipse is still successfully covering mares in Kentucky at the age of 31, the result of late and light service till his sinews became fully matured. We almost daily see a large, compact, flea-bitten horse, at work, dragging a heavy load in a single cart, which was formerly used as one of Governor Maitland's coach horses, and though now upwards of 30, is apparently as sound and vigorous as an overtasked colt of seven or eight.

FEEDING.—The vigor and duration of the horse depend much on proper feeding. Like the cow and sheep, he may be made to subsist on animal food, fish and almost every species of nutritious vegetable. But his natural and proper aliment is the grasses, grain and roots. In the middle and northern section of this country, his dry forage is almost invariably good meadow hay, generally timothy, which is the richest of the cultivated grasses. At the South, this is often supplied by the blades of Indian corn. But in all the states, a great variety of the grasses and clover are used. When put to hard labor, grain ought always to accompany hay in some form. Of the different kinds of grain, oats are peculiarly the horse's food, and they are always safe, digestible and nutritive. Barley is the best substitute for it. Wheat and Indian corn are sometimes given, but both are unsuitable; the first is too concentrated, and the last too heating. They ought to be sparingly used, and only when ground. The offal of wheat is never objectionable. Grain is always more advantageously fed when ground or crushed, and wet some time previous to eating; and it is still better when cooked. On both sides of the Mediterranean, in the Barbary states, in Spain, France and Italy, much of the food is given in small baked cakes, and the saving in this way is much greater than the expense of preparing it. When confined to dry food, roots or apples fed once a day, are always beneficial. They keep the bowels open, the appetite and general health good, and contribute largely to the nutriment of the animal. Carrots are the best of the roots, as besides giving muscle and working power, they more than any

other, improve the wind and remove all tendency to heaves. They have even been found effectual in curing an obstinate cough. By many of the keepers of livery stables, they are always used, for which purpose they command the same price as oats. Potatoes, parsneps, beets and Swedes turneps in the order mentioned, are next to be preferred. Potatoes are improved by cooking. Mixtures of food are best, as of cut hay, meal and roots. Old horses, or such as are put to hard labor, will do much better if their food be given in the form easiest of digestion. No inconsiderable part of the vital power is exhausted by the digestion of dry, raw food. Horses ought to be fed, and if possible, exercised or worked regularly, but never on a full stomach. This is a frequent cause of disease, and especially of broken wind. If their food is given at the proper time, and the horse be allowed to finish it at once, without expecting more, he will lie down quietly and digest it. This will be much more refreshing to him, than to stand at the rack or trough, nibbling continually at his hay or oats. What remains after he has done feeding, should be at once withdrawn. They should have water in summer three times, and in winter twice a day. Soft or running water is much the best. While working, and they are not too warm, they may have it as often as they desire. Neither should they be fed when heated, as the stomach is then fatigued and slightly inflamed, and is not prepared for digestion till the animal is again cool. Salt should always be within reach, and we have found an occasional handful of clean wood ashes, a preventive of disease and an assistance to the bowels and appetite.

DISEASES.

The list is long and fearful, and even the brief one subjoined, will be found sufficiently great, to inculcate the utmost caution in their management. The horse in his natural condition is subject to few ailments. It is only in his intensely artificial state, and when made the slave of man, that he becomes a prey to disease in almost every shape. A careful and judicious attention to his diet, water, exercise, stable, and general management, will prevent many of those to which he is subject.

Glanders is one of the most alarming. The first and most marked symptom is a discharge from the nostrils of a peculiar character. The disease produces inflammation there, and in the windpipe, and finally, in aggravated cases, passes

down to the lungs, which are soon destroyed. It is propagated by contagion, by exposure in humid stables, and is induced by hereditary indisposition and great exhaustion. Youatt says, there is not a disease which may not lay the foundation for glanders. The poison resides in the nasal discharge, not in the breath. When exposed to it, the mangers should be thoroughly scraped, washed with soap and water, and afterwards with chloride of lime. All the clothing and harness which may have received any of the contagious matter, must be thoroughly cleansed and baked. The best preventives are dry, clean and well ventilated stables, proper exercise, and green food in summer, and roots in winter. The disease may be arrested in its early stages, by turning the animal on a dry pasture, but it is liable to return on subsequent confinement. Iodine has lately been announced as a remedy, but of the certainty of its effects, we are not aware. It is generally considered incurable, and when thoroughly seated, it may be deemed an act both of humanity and economy, to terminate the existence of its victim at once. This course becomes a duty, from the fact that many grooms, by their attendance on glandered horses, have been affected, and though the disease is in their case more managable, yet it is frequently fatal. *Farcy* is intimately connected with glanders, and the diseases frequently run into each other.

LAMPAS consist in the swelling of the bars of the mouth to a level or even above the teeth. It may occur from inflammation of the gums; shedding of the teeth; a febrile tendency, and from over feeding or want of exercise. It will generally subside by low dieting and proper exercise; or it may be at once relieved, by lancing the bars with a sharp pen-knife.

POLL-EVIL arises from some contusion or injury to the head, which produces a swelling that eventually suppurates. The inflammation may be abated in its earliest stages, by a blister, and later, by bleeding, physic, and cold lotions applied to the part. If these are ineffectual, and the swelling continues, it should be hastened by poultices, and warm, stimulating lotions; and when fully formed, the tumor must be opened, so as to permit all the matter to run out. Repeated applications of salt will sometimes cure it.

HEAVES.—All those affections, distinguished in the English veterinary works, as *pnuemonia or inflammation of the lungs, chronic cough, thick and broken wind, consumption, &c.*, are popularly designated as heaves. To some or all of these the horse may have an hereditary or constitutional tendency.

Their incipient stages are also induced by a sudden transition from heat to cold, and sometimes from cold to close and hot stables; and by a chilly wind or damp stables, especially after severe exercise. Feeding on musty, dry hay, or on straw, will produce an irritation which may lead to heaves. *Inflammation of the lungs* is frequently dangerous, and requires the immediate and full use of the lancet. After the inflammation is decidedly allayed by copious bleeding, small doses of aloes may be given, and frequent injections of warm soap and water, which should be omitted the moment the fæces becomes soft and approaching to the fluid state. Blistering the sides and brisket, and often repeated if otherwise ineffectual, must be resorted to. Convalescence should be followed with sedative medicines, and during all the severe stages of the disease, withhold all food except light gruels after protracted abstinence. As health returns, put the animal out to grass. Inflammation of the lungs is sometimes succeeded by a *chronic cough*, and the other maladies enumerated. When firmly seated, it is incapable of removal. Its effects can be alleviated, and with suitable food and treatment, the horse may be made to do much moderate labor for many years, but he can never become sound or sustain great exertion. Equal and proper temperature, moist, stimulating food, and especially carrots or potatoes, and moderate exercise, but never on a full stomach, and dry, clean stables, are all the remedies that can be prescribed.

CATARRH OR HORSE DISTEMPER sometimes attacks the horse in the spring or fall, and is shown by soreness and swelling in the glands of the throat, a cough, difficulty of swallowing, discharging at the nose, and general prostration. It is seldom fatal if properly managed. Give light bran-mashes, purge thoroughly, and keep warm. If he is violently attacked, he may be bled while fever exists, and blisters or seatons may be applied, to reduce the swelling if extreme. The disease is contagious, and the animal should be at once placed where he cannot communicate it.

SPASMODIC COLIC.—"The attack of colic is usually very sudden. There is often not the slightest warning. The horse begins to shift his posture, look round at his flanks, paw violently, strike his belly with his feet, and crouch in a peculiar manner, advancing his hind limbs under him; he will then suddenly lie, or rather fall down, and balance himself upon his back, with his feet resting on his belly. The pain now seems to cease for a little while, and he gets up, and

shakes himself, and begins to feed; the respite, however, is but short—the spasm returns more violently—every indication of pain is increased—he heaves at the flanks, breaks out into a profuse perspiration, and throws himself more recklessly about. In the space of an hour or two, either the spasms begin to relax, and the remissions are of longer duration, or the torture is augmented at every paroxysm; the intervals of ease are fewer and less marked, and inflammation and death supervene. The pulse is but little affected at the commencement, but it soon becomes frequent and contracted, and at length is scarcely tangible.

Among the causes of colic are, the drinking of cold water when the horse is heated. There is not a surer origin of violent spasm than this. Hard water is very apt to produce this effect. Colic will sometimes follow the exposure of a horse to the cold air or a cold wind after strong exercise. Green meat, although, generally speaking, most beneficial to the horse, yet, given in too large a quantity, or when he is hot, will frequently produce gripes. Doses of aloes, both large and small, are not unfrequent causes of colic. In some horses there seems to be a constitutional predisposition to colic. They cannot be hardly worked, or exposed to unusual cold, without a fit of it. In many cases, when these horses have died, calculi have been found in some part of the alimentary canal. Habitual costiveness and the presence of calculi are frequent causes of spasmodic colic. The seat of colic is occasionally the duodenum, but oftener the ileum or the jejunum; sometimes, however, both the cæcum and colon are affected. Fortunately, we are acquainted with several medicines that allay these spasms; and the disease often ceases as suddenly as it appeared. Turpentine is one of the most powerful remedies, especially in union with opium, and in good warm ale. A solution of aloes will be advantageously added to the turpentine and opium. If relief is not obtained in half-an-hour, it will be prudent to bleed, for the continuance of violent spasm may produce inflammation. Some practitioners bleed at first, and it is far from bad practice; for although the majority of cases will yield to turpentine, opium, and aloes, an early bleeding may occasionally prevent the recurrence of inflammation, or at least mitigate it. If it is clearly a case of colic, half of the first dose may be repeated, with aloes dissolved in warm water. The stimulus produced on the inner surface of the bowels by the purgative may counteract the irritation that caused the spasm.

The belly should be well rubbed with a brush or warm cloth, but not bruised and injured by the broom-handle rubbed over it, with all their strength, by two great fellows. The horse should be walked about, or trotted moderately. The motion thus produced in the bowels, and the friction of one intestine over the other, may relax the spasm, but the hasty gallop might speedily cause inflammation to succeed to colic. Clysters of warm water, or containing a solution of aloes, should be injected. The patent syringe will here be exceedingly useful. A clyster of tobacco-smoke may be thrown up as a last resort. When relief has been obtained, the clothing of the horse, saturated with perspiration, should be removed, and fresh and dry clothes substituted. He should be well littered down in a warm stable or box, and have bran mashes and lukewarm water for the two or three next days. Some persons give gin, or gin and pepper, or even spirit of pimento, in cases of gripes. This course of proceeding is, however, exceedingly objectionable. It may be useful, or even sufficient, in ordinary cases of colic; but if there should be any inflammation or tendency to inflammation, it cannot fail to be highly injurious.

Flatulent colic.—This is altogether a different disease from the former. It is not spasm of the bowels, but inflation of them from the presence of gas emitted by undigested food. Whether collected in the stomach, or small or large intestines, all kinds of vegetable matter are liable to ferment. In consequence of this fermentation, gas is evolved to a greater or less extent—perhaps to twenty or thirty times the bulk of the food. This may take place in the stomach; and if so, the life of the horse is in immediate danger, for the animal has no power to expel this dangerous flatus by eructation.

The symptoms, according to Professor Stewart, are, "the horse suddenly slackening his pace—preparing to lie down, or falling down as if he were shot. In the stable he paws the ground with his fore feet, lies down, rolls, starts up all at once, and throws himself down again with great violence, looking wistfully at his flanks, and making many fruitless attempts to void his urine." The treatment is considerably different from that of spasmodic colic. The spirit of pimento would be here allowed, or the turpentine and opium drink; but if the pain, and especially the swelling, do not abate, the gas, which is the cause of it, must be got rid of, or the animal is inevitably lost. This is usually or almost invariably a combination of hydrogen with some other gas. It has a

strong affinity for chlorine. Then if some compound of chlorine—the chloride of lime—dissolved in water, is administered in the form of a drink, the chlorine separates from the lime as soon as it comes in contact with the hydrogen, and muriatic gas is formed. This gas having a strong affinity for water, is absorbed by any fluid that may be present, and, quitting its gaseous form, either disappears, or does not retain a thousandth part of its former bulk. All this may be very rapidly accomplished, for the fluid is quickly conveyed from the mouth to every part of the intestinal canal. Where these two medicines are not at hand, and the danger is imminent, the trochar may be used, in order to open a way for the escape of the gas. The trochar should be small but longer than that which is used for the cow, and the puncture should be made in the middle of the right flank, for there the large intestines are most easily reached. It is only when the practitioner despairs of otherwise saving the life of the animal that this operation should be attempted. Much of the danger would be avoided by using a very small trochar, and by withdrawing it as soon as the gas has escaped. The wonnd in the intestines will then probably close, from the innate elasticity of the parts.

Inflammation of the bowels.—There are two varieties of this malady. The first is inflammation of the external coats of the intestines, accompanied by considerable fever, and usually costiveness. The second is that of the internal or mucous coat, and almost invariably connected with purging. The muscular coat is that which is oftenest affected. Inflammation of the external coats of the stomach, whether the peritoneal or muscular, or both, is a very frequent and fatal disease. It speedily runs its course, and it is of great consequence that its early symptoms should be known. If the horse has been carefully observed, restlessness and fever will have been seen to precede the attack. In many cases a direct shivering fit will occur: the mouth will be hot, and the nose red. The animal will soon express the most dreadful pain by pawing, striking at his belly, looking wildly at his flanks, groaning, and rolling. The pulse will be quickened and small; the ears and legs cold; the belly tender, and sometimes hot; the breathing quickened; the bowels costive; and the animal becoming rapidly and fearfully weak.

The causes of this disease are, first of all and most frequently, sudden exposure to cold. If a horse that has been highly fed, carefully groomed, and kept in a warm stable, is

heated with exercise, and has been during some hours without food, and in this state of exhaustion is suffered to drink freely of cold water, or is drenched with rain, or have his legs and belly washed with cold water, an attack of inflammation of the bowels will often follow. An overfed horse, subjected to severe and long-continued exertion, if his lungs were previously weak, will probably be attacked by inflammation of them; but if the lungs were sound, the bowels will on the following day be the seat of disease. Stones in the intestines are an occasional cause of inflammation, and colic neglected or wrongly treated will terminate in it.

The treatment of inflammation of the bowels, like that of the lungs, should be prompt and energetic. The first and most powerful means of cure will be bleeding. From six to eight or ten quarts of blood, in fact as much as the horse can bear, should be abstracted as soon as possible; and the bleeding repeated to the extent of four or five quarts more, if the pain is not relieved and the pulse has not become rounder and fuller. The speedy weakness that accompanies this disease should not deter from bleeding largely. That weakness is the consequence of violent inflammation of these parts; and if that inflammation is subdued by the loss of blood, the weakness will disappear. The bleeding should be effected on the first appearance of the disease, for there is no malady that more quickly runs its course. A strong solution of aloes should immediately follow the bleeding, but, considering the irritable state of the intestines at this period, guarded by opium. This should be quickly followed by backraking, and injections consisting of warm water, or very thin gruel, in which Epsom salts or aloes have been dissolved; and too much fluid can scarcely be thrown up. The horse should likewise be encouraged to drink plentifully of warm water or thin gruel; and draughts, each containing a couple of drachms of dissolved aloes, with a little opium, should be given every six hours, until the bowels are freely opened. It will now be prudent to endeavor to excite considerable external inflammation as near as possible to the seat of internal disease, and therefore the whole of the belly should be blistered. In a well-marked case of this disease, no time should be lost in applying fomentations, but the blister at once resorted to. The tincture of Spanish flies, whether made with spirits of wine or turpentine, should be thoroughly rubbed in. The legs should be well bandaged in order to restore the circulation in them, and thus lessen the flow of blood to the

inflamed part; and, for the same reason, the horse should be warmly clothed, but the air of the stable or box should be cool. No corn or hay should be allowed during the disease, but bran mashes, and green meat if it can be procured. The latter will be the best of all food, and may be given without the slightest apprehension of danger. When the horse begins to recover, a handful of grain may be given two or three times in the day; and, if the weather is warm, he may be turned into a paddock for a few hours in the middle of the day. Clysters of gruel should be continued for three or four days after the inflammation is beginning to subside, and good hand-rubbing applied to the legs.

The second variety of inflammation of the bowels affects the internal or mucous coat, and is generally the consequence of physic in too great quantity, or of an improper kind. The purging is more violent and continues longer than was intended; the animal shows that he is suffering great pain; he frequently looks round at his flanks; his breathing is laborious, and the pulse is quick and small, and the mouth is hot and the legs and ears are warm. Unless the purging is excessive, and the pain and distress great, the surgeon should hesitate at giving any astringent medicine at first; but he should plentifully administer gruel or thin starch, or arrow-root, by the mouth and by clyster, removing all hay and corn, and particularly green meat. He should thus endeavor to soothe the irritated surface of the bowels, while he permits all remains of the purgative to be carried off. If, however, twelve hours have passed, and the purging and the pain remain undiminished, he should continue the gruel, adding to it chalk, catechu, and opium, repeated every six hours. As soon as the purging begins to subside, the astringent medicine should be lessened in quantity, and gradually discontinued. Bleeding will rarely be necessary, unless the inflammation is very great, and attended by symptoms of general fever. The horse should be warmly clothed, and placed in a comfortable stable, and his legs should be hand-rubbed and bandaged. Violent purging, and attended with much inflammation and fever, will occur from other causes. Green meat will frequently purge. A horse worked hard upon green meat will sometimes scour. The remedy is change of diet, or less labor. Young horses will often be strongly purged, without any apparent cause. Astringents should be used with much caution here. It is probably an effort of nature to get rid of something that offends. A few doses of gruel will assist in

effecting this purpose, and the purging will cease without astringent medicine. Many horses that are not *well-ribbed home*—having too great space between the last rib and the hip-bone—are subject to purging if more than usual exertion is required from them. They are recognised by the term of *washy* horses. They are often free and fleet, but destitute of continuance. They should have rather more than the usual allowance of corn, with beans, when at work. A cordial ball, with catechu and opium, will often be serviceable either before or after a journey.

PHYSICKING.—When a horse comes from grass to hard meat, or from the cool, open air to a heated stable, a dose or even two doses of physic may be useful to prevent the tendency to inflammation which is the necessary consequence of so sudden and great a change. To a horse that is becoming too fat, or has surfeit, or grease, or mange, or that is out of condition from inactivity of the digestive organs, a dose of physic is often most serviceable. A horse should be carefully prepared for the action of physic. Two or three bran mashes given on that or the preceding day are far from sufficient when a horse is about to be physicked, whether to promote his condition or in obedience to custom. Mashes should be given until the dung becomes softened. A less quantity of physic will then suffice, and it will more quickly pass through the intestines, and be more readily diffused over them. Five drachms of aloes, given when the dung has thus been softened, will act more effectually and much more safely than seven drachms, when the lower intestines are obstructed by hardened fæces. On the day on which the physic is given, the horse should have walking exercise, or may be gently trotted for a quarter of an hour twice in the day; but after the physic begins to work, he should not be moved from his stall. Exercise would then produce gripes, irritation, and, possibly, dangerous inflammation. A little hay may be put into the rack. As much mash should be given as the horse will eat, and as much water, with the coldness of it taken off, as he will drink. If, however, he obstinately refuses to drink warm water, it is better that he should have it cold, than to continue without taking any fluid; but in such case he should not be suffered to take more than a quart at a time, with an interval of at least an hour between each draught. When the purging has ceased, or *the physic is set*, a mash should be given once or twice every day until the next dose is taken, between which and the *setting* of the first there should be an

interval of a week. The horse should recover from the languor and debility occasioned by the first dose, before he is harrassed by a second. Eight or ten tolerably copious motions will be perfectly sufficient to answer every good purpose, although the groom or the carter may not be satisfied unless double the quantity are procured. The consequence of too strong purgation will be, that weakness will hang about the animal for several days or weeks, and inflammation will often ensue from the over-irritation of the intestinal canal. Long-continued custom has made ALOES the almost invariable purgative of the horse, and very properly so; for there is no other at once so sure and so safe. The Barbadoes aloes, although sometimes very dear, should alone be used. The dose, with a horse properly prepared, will vary from four to seven drachms. Custom has assigned the form of a ball to physic, but good sense will in due time introduce the solution of aloes, as acting more speedily, effectually, and safely. The only other purgative on which dependence can be placed is the CROTON. The farina or meal of the nut is generally used; but from its acrimony it should be given in the form of ball, with linseed meal. The dose varies from a scruple to half a drachm. It acts more speedily than the aloes, and without the nausea which they produce; but it causes more watery stools, and, consequently, more debility. LINSEED-OIL is an uncertain but safe purgative, in doses from a pound to a pound and a half. OLIVE-OIL is more uncertain, but safe; but CASTOR-OIL, that mild aperient in the human being, is both uncertain and unsafe. EPSOM-SALTS are inefficacious, except in the immense dose of a pound and a half, and then they are not always safe.

WORMS.—The long white worm (*lumbricus teres*) much resembles the common earth-worm, and, being from six to ten inches in length, inhabits the small intestines. It is a formidable looking animal; and if there are many of them, they may consume more than can be spared of the nutritive part of the food, or the mucus of the bowels. A tight skin, and rough coat, and tucked-up belly, are sometimes connected with their presence. They are then, however, voided in large quantities. A dose of physic will sometimes bring away almost incredible quantities of them. Calomel is frequently given as a vermifuge. The seldomer this drug is administered to the horse the better. When the horse can be spared, a strong dose of physic is an excellent vermifuge, so far as the long round worm is concerned; but a better

medicine, and not interfering with either the feeding or work of the horse, is emetic tartar, with ginger, made into a ball with linseed meal and treacle, and given every morning, half an hour before the horse is fed. A smaller, darker colored worm, called the needle-worm, or *ascaris*, inhabits the larger intestines. Hundreds of them sometimes descend into the rectum, and immense quantities have been found in the cœcum. These are a more serious nuisance than the former, for they cause a very troublesome irritation about the fundament, which sometimes sadly annoys the horse. Their existence can generally be discovered by a small portion of mucus, which, hardening, is found adhering to the anus. Physic will sometimes bring away great numbers of these worms; but when there is much irritation about the tail, and much of this mucus, indicating that they have descended into the rectum, an injection of linseed oil, or of aloes dissolved in warm water, will be a more effectual remedy. The tape-worm is seldom found in the horse.

Bots cannot, while they inhabit the stomach of the horse, give the animal any pain, for they have fastened on the cuticular and insensible coat. They cannot stimulate the stomach and increase its digestive power, for they are not on the digestive portion of the stomach. They cannot, by their roughness, assist the trituration or rubbing down of the food, for no such office is performed in that part of the stomach—the food is softened, not rubbed down. They cannot be injurious to the horse, for he enjoys the most perfect health when the cuticular part of his stomach is filled with them, and their presence is not even suspected until they appear at the anus. They cannot be removed by medicine, because they are not in that part of the stomach to which medicine is usually conveyed; and if they were, their mouths are too deeply buried in the mucus for any medicine, that can be safely administered, to affect them; and, last of all, in due course of time they detach themselves, and come away. Therefore, the wise man will leave them to themselves, or content himself with picking them off when they collect under the tail and annoy the animal.

Wind-galls.—In the neighborhood of the fetlock there are occasionally found considerable enlargements, oftener on the hind-leg than the fore-one, which are denominated *wind-galls*. Between the tendons and other parts, and wherever the tendons are exposed to pressure or friction, and particularly about their extremeties, little bags or sacs are placed,

containing and suffering to ooze slowly from them a mucous fluid to lubricate the parts. From undue pressure, and that most frequently caused by violent action and straining of the tendons, or, often, from some predisposition about the horse, these little sacs are injured. They take on inflammation, and sometimes become large and indurated. There are few horses perfectly free from them. When they first appear, and until the inflammation subsides, they may be accompanied by some degree of lameness; but otherwise, except when they attain a great size, they do not interfere with the action of the animal, or cause any considerable unsoundness. The farriers used to suppose that they contained wind—hence their name, wind-galls; and hence the practice of opening them, by which dreadful inflammation was often produced, and many a valuable horse destroyed. A slight wind-gall will scarcely be subjected to treatment; but if these tumors are numerous and large, and seem to impede the motion of the limb, they may be attacked first by bandage. The roller should be of flannel, and soft pads should be placed on each of the enlargements, and bound down tightly upon them. The bandage should also be wetted with warm water two or three times a day for half an hour each time. The wind-gall will often diminish or disappear by this treatment, but will too frequently return when the horse is again hardly worked. A blister is more effectual, but too often temporary remedy. Wind-galls will return with the renewal of work. Firing is still more certain, if the tumors are sufficiently large and annoying to justify our having recource to measures so severe; for it will not only effect the immediate absorption of the fluid, and the reduction of the swelling, but, by contracting the skin, will act as a permanent bandage, and therefore prevent the re-appearance of the tumor. The iodine and mercurial ointments have occasionally been used with advantage in the proportion of three parts of the former to two of the latter-

The Fetlock.—The fetlock-joint is a very complicated one, and from the stress which is laid on it, and its being the principal seat of motion below the knee, it is particularly subject to injury. There are not many cases of sprain of the back-sinew that are not accompanied by inflammation of the ligaments of this joint; and uumerous supposed cases of sprain higher up are simple affections of the fetlock. It requires a great deal of care, and some experience, to dis'inguish the one from the other. The heat about the part, and

the point at which the horse least endures the pressure of the finger, will be the principal guides. Occasionally, by the application of cooling lotions, the inflammation may be subdued, but at other times, the horse suffers dreadfully, and is unable to stand. A serious affection of the fetlock-joint demands prompt treatment.

CUTTING—The inside of the fetlock is often bruised by the shoe or the hoof of the opposite foot. Many expedients used to be tried to remove this; the inside heel has been raised and lowered, and the outside raised and lowered; and sometimes one operation has succeeded, and sometimes the contrary; and there was no point so involved in obscurity or so destitute of principles to guide the practitioner. The most successful remedy, and that which in the great majority of cases supercedes all others, is Mr. Turner's shoe, of equal thickness from heel to toe, and having but one nail, and that near the toe on the inside of the shoe; care being taken that the shoe shall not extend beyond the edge of the crust, and that the crust shall be rasped a little at the quarters.

SPRAIN OF THE COFFIN-JOINT.—The proof of this is when the lameness is sudden, and the heat and tenderness are principally felt round the coronet. Bleeding at the toe, physic, fomentation, and blisters are the usual means adopted. This lameness is not easily removed, even by a blister; and if removed, like sprains of the fetlock and of the back sinews, it is apt to return, and finally produce a great deal of disorganization and mischief in the foot. Sprain of the coffin-joint sometimes becomes a very serious affair. Not being always attended by any external swelling and being detected only by heat round the coronet, the seat of the lameness is often overlooked by the groom and the farrier; and the disease is suffered to become confirmed before its nature is discovered.

RINGBONE.—This is a deposit of bony matter in one of the pasterns, and usually near the joint. It rapidly spreads, and involves not only the pastern-bones, but the cartilages of the foot, and spreading around the pasterns and cartilages, thus derives its name. When the first deposit is on the lower pastern, and on both sides of it, and produced by violent inflammation of the ligaments of the joints, it is recognised by a slight enlargement, or bony tumor on each side of the foot, and just above the coronet. Horses with short upright joints, and with small feet and high action, are oftenest, as may be supposed, the subjects of this disease, which is the

consequence either of concussion or sprain of the pastern-joints. It is also more frequent in the hind foot than the fore, because, from the violent action of the hind legs in propelling the horse forward, the pasterns are more subject to ligamentary injury behind than before ; yet the lameness is not so great there, because the disease is confined principally to the ligaments, and the bones have not been injured by concussion ; while from the position of the fore limbs, there will generally be in them injury of the bones to be added to that of the ligaments. In its early stage, and when recognised only by a bony enlargement on both sides of the pastern-joint, or in some few cases on one side only, the lameness is not very considerable, and it is not impossible to remove the disease by active blistering, or by the application of the cautery ; but there is so much wear and tear in this part of the animal, that the inflammation and the disposition to the formation of bone rapidly spread. The pasterns first become connected together by bone instead of ligament, and thence results what is called an anchylosed or fixed joint. From this joint the disease proceeds to the cartilages of the foot, and to the union between the lower pastern, and the coffin and navicular bones. The motion of these parts likewise is impeded or lost, and the whole of the foot becomes one mass of spongy bone.

Enlargement of the hock.—First, there is inflammation, or *sprain of the hock-joint generally*, arising from sudden violent concussion, by some check at speed, or over-weight, and attended with enlargement of the whole joint, and great tenderness and lameness. This, however, like all other diffused inflammations, is not so untractable as an intense one of a more circumscribed nature, and by rest and fomentation, or, perchance, firing, the limb recovers its action, and the horse becomes fit for ordinary work. The swelling, however, does not always subside. Enlargement, spread over the whole of the hock-joint, remains. A horse with an enlarged hock must always be regarded with suspicion. In truth, he is unsound. The parts, altered in structure, must be to a certain degree weakened. The animal may discharge his usual work during a long period, without return of lameness ; but if one of those emergencies should occur when all his energies require to be exerted, the disorganised and weakened part will fail. He may be ridden or driven moderately for many a year without inconvenience, yet one extra hard day's work may lame him for ever.

CURB.—There are often injuries of particular parts of the hock-joint. *Curb* is an affection of this kind. It is an enlargement at the back of the hock, three or four inches below its point. It is either a strain of the ring-like ligament which binds the tendons in their place, or of the sheath of the tendons; oftener, however, of the ligament than of the sheath. Any sudden action of the limb of more than usual violence may produce it, and therefore horses are found to 'throw out curbs' after a hardly-contested race, an extraordinary leap, a severe gallop over heavy ground, or a sudden check in the gallop. Young horses are particularly liable to it, and horses that are *cow-hocked*,—whose hocks and legs resemble those of the cow, the hocks being turned inward, and legs forming a considerable angle outwards. This is intelligible enough; for in hocks so formed, the annular ligament must be continually on the stretch, in order to confine the tendon. Curbs are generally accompanied by considerable lameness at their first appearance, but the swelling is not always great. They are best detected by observing the leg sideway. The first object in attempting the cure is to abate inflammation, and this will be most readily accomplished by cold evaporating lotions frequently applied to the part. Equal portions of spirit of wine, water, and vinegar, will afford an excellent application. It will be almost impossible to keep a bandage on. If the heat and lameness are considerable, it will be prudent to give a dose of physic, and to bleed from the subcutaneous vein, whose course is near it; and whether the injury is of the annular ligament, or the sheath of the tendon, more active means will be necessary to perfect a cure. Either a liquid blister should be rubbed on the part, consisting of a vinus or turpentine tincture of cantharides, and this daily applied until some considerable swelling takes place; or, what is the preferable plan, the hair should be cut off, and the part blistered as soon as the heat has been subdued. The blister should be repeated until the swelling has disappeared, and the horse goes sound. In severe cases it may be necessary to fire; but a fair trial, however, should be given to milder measures. If the iron is used, it should be applied in straight lines. There are few lamenesses in which absolute and long-continued rest is more requisite. It leaves the parts materially weakened, and, if the horse is soon put to work again, the lameness will frequently return. No horse that has had curbs, should be put even to ordinary work in less than a month after the apparent cure; and, even

then, he should very gradually resume his former habits. A horse with a curb, is manifestly unsound, or generally condemned as unsound. Curb is also an hereditary complaint; and therefore a horse that has once suffered from it, should always be regarded with suspicion, especially if either of the parents have exhibited it.

Bone spavin is an affection of the bones of the hock joint. Spavined horses are generally capable of slow work. They are equal to the greater part of the work of the farm, and therefore they should not always be rejected by the small farmer, as they may generally be procured at little price. These horses are not only capable of agricultural work, but they generally improve under it. The lameness in some degree abates, and even the bony tumor to a certain degree lessens. There is sufficient moderate motion and friction of the limb to rouse the absorbents to action, and cause them to take up a portion of the bony matter thrown out, but not enough to renew or prolong inflammation. It cannot be said that the plough affords a *cure* for spavin, but the spavined horse often materially improves while working at it. For fast work, and for work that must be regularly performed, spavined horses are not well calculated; for this lameness behind produces great difficulty in rising, and the consciousness that he will not be able to rise without painful effort occasionally prevents the horse from lying down at all; and the animal that cannot rest well cannot long travel far or fast. The treatment of spavin is simple enough, but far from being always effectual. The owner of the horse will neither consult his own interest, nor the dictates of humanity, if he suffers the chisel and mallet, or the gimlet, or the pointed iron, or arsenic, to be used; yet measures of considerable severity must be resorted to. Repeated blisters will usually cause either the absorption of the bony deposit, or the abatement or removal of the inflammation of the ligaments, or, as a last resource, the heated iron may be applied.

Swelled legs.—The fore legs, but oftener the hind ones, and especially in coarse horses, are sometimes subject to considerable enlargement. Occasionally, when the horse does not seem to labor under any other disease, and sometimes from an apparent shifting of disease from other parts, the hind legs suddenly swell to an enormous degree from the hock and almost from the stifle to the fetlock, attended by a greater or less degree of heat, and tenderness of the skin, and sometimes excessive and very peculiar lameness. The pulse

likewise becomes quick and hard, and the horse evidently labors under considerable fever. It is acute inflammation of the cellular substance of the legs, and that most sudden in its attack, and most violent in its degree, and therefore attended by the effusion of a considerable quantity of fluid into the cellular membrane. It occurs in young horses, and in those which are over-fed and little exercised. Fomentation, diuretics, or purgatives, or, if there is much fever, a moderate bleeding will often relieve the distention almost as suddenly as it appeared.

The cure, when the case has not been too long neglected, is sufficiently plain. Physic, or diuretics, or both, must be had recourse to. Mild cases will generally yield to their influence; but, if the animal has been negleted, the treatment must be decisive. If the horse is in high condition, these should be preceded or accompanied by bleeding; but if there are any symptoms of debility, bleeding would only increase the want of tone in the vessels. Horses taken from grass and brought into close stables very speedily have swelled legs, because the difference of food and increase of nutriment rapidly increases the quantity of the circulating fluid, while the want of exercise takes away the means by which it might be got rid of. The remedy here is sufficiently plain. Swelled legs, however, may proceed from general debility. They may be the consequence of starvation, or disease that has considerably weakened the animal; and these parts, being farthest from the center of circulation, are the first to show the loss of power by the accumulation of fluid in them. Here the means of cure would be to increase the general strength, with which the extremeties would sympathise. Mild diuretics and tonics would therefore be evidently indicated.

Horses in the spring and fall are subject to swelled legs. The powers of the constitution are principally employed in providing a new coat for the animal, and the extremeties have not their share of vital influence. Mingled cordials and diuretics are indicated here—the diuretic to lessen the quantity of the circulating fluid, and the cordial to invigorate the frame.

Grease.—Swelled legs, although distinct from grease, is a disease that is apt to degenerate into it. Grease is a specific inflammation of the skin of the heels, sometimes of the fore-feet, but oftener of the hinder ones. Bad stable management is the true cause of it. Grease is a local complaint. The heel should be well but gently washed with soap and water, and as much of the scurf detached as is easily remo-

vable. An ointment should be applied, to supple, cool, and heal the part. When cracks appear the mode of treatment will depend on their extent and depth. If the cracks are deep, with an ichorous discharge and considerable lameness, it will be necessary to poultice the heel. A poultice of linseed meal will be generally effective, unless the discharge is thin and offensive, when an ounce of finely-powdered charcoal should be mixed with the linseed meal; or a poultice of carrots, boiled soft and mashed. After the chaps or cracks have healed, the legs will sometimes continue gorged and swelled. A flannel bandage, evenly applied over the whole of the swelled part, will be very serviceable; or, should the season admit of it, a run at grass, particularly spring grass, should be allowed.

The feeding should likewise vary with the case, but with these rules, which admit of no exception, that green meat should be given, and more especially carrots, when they are not too expensive, and mashes, if the horse will eat them, and never the full allowance of grain.

Walking exercise should be resorted to as soon as the horse is able to bear it, and this by degrees may be increased to a gentle trot.

From bad stable management at first, and neglect during the disease, a yet worse kind of grease occasionally appears. The ulceration extends over the skin of the heel and the fetlock, and a fungus springs from the surface of both, highly sensible, bleeding at the slightest touch, and interspersed with scabs. By degrees portions of the fungus begin to be covered with a horny substance, protruding in the form of knobs, and collected together in bunches. These are known by the name of *grapes*. A fœtid and very peculiar exhudadation proceeds from nearly the whole of the unnatural substance. The horse evidently suffers much, and is gradually worn down by the discharge. The assistance of a veterinary surgeon is here indispensible.

Some horses are more subject to grease than others, particularly draught-horses, both heavy and light, but particularly the former, and if they have no degree of blood in them. It was the experience of this which partly contributed to the gradual change of coach and other draught-horses to those of a lighter breed. In the great majority of cases, grease arises from mismanagement and neglect.

Everything that has a tendency to excite inflammation in the skin of the heel is a cause of grease. Therefore want

of exercise is a frequent source of this disease. When high feeding is added to irregular or deficient exercise, the disease is evidently still more likely to be produced. Want of cleanliness in the stable is a fruitful source of grease. When the heels are imbedded in filth, they are weakened by the constant moisture surrounding them—irritated by the acrimony of the dung and urine, and little prepared to endure the cold evaporation to which they are exposed when the horse is taken out of the stable. The absurd practice of washing the feet and legs of horses when they come from their work, and either carelessly sponging them down afterwards, or leaving them to dry as they may, is, however, the most common origin of grease.

When the horse is warmed by his work, and the heels share in the warmth, the momentary cold of washing may not be injurious, if the animal is immediately rubbed dry; yet even this would be better avoided: but to wash out the heels, and then leave them partially dry or perfectly wet, and suffering from the extreme cold that is produced by evaporation from a moist and wet surface is the most absurd, dangerous and injurious practice that can be imagined. It is worse when the post-horse or the plough-horse is plunged up to his belly in the river or pond immediately after his work.

There has been some dispute as to the propriety of cutting the hair from the heels. Custom has very properly retained the hair on our farm-horses. Nature would not have given it had it not been useful. It guards the heel from being injured by the inequalities of the ploughed field, and prevents the dirt, in which the heels are constantly enveloped, from reaching and caking on and irritating the skin. When the horse is carefully tended after his work is over, and his legs quickly and completely dried, the less hair he has about them the better, for then both the skin and the hair can be made perfectly dry before evaporation begins or proceeds so far as to deprive the legs of their heat. Grease is the child of negligence and mismanagement.

SETONS are pieces of tape or cord, passed, by means of an instrument resembling a large needle, either through abscesses, or the base of ulcers with deep sinuses, or between the skin and the muscular or other substances beneath. They are retained there by the ends being tied together, or by a knot at each end. The tape is moved in the wound twice or thrice in the day, and occasionally wetted with spirit of turpentine, or some acrid fluid, in order to increase the inflam-

mation which it produces, or the discharge which is intended to be established.

In abscesses, such as occur in the withers or the poll, and when passed from the summit to the very bottom of the the swelling, setons are highly useful by discharging the purulent fluid and suffering any fresh quantity of it that may be secreted to flow out; and, by the degree of inflammation which they excite on the interior of the tumor, stimulating it to throw out healthy granulations, which gradually occupy and fill the hollow. In deep fistulous wounds they are indispensable, for except some channel is made through which the matter may flow from the bottom of the wound, it will continue to penetrate deeper into the part, and the healing process will never be accomplished. On these accounts a seton passes through the base of the ulcer in poll-evil and fistulous withers is of so much benefit.

Setons are sometimes useful by promoting a discharge in in the neighborhood of an inflamed part, and thus diverting and carrying away a portion of the fluids which distend or overload the vessels of that part; thus, a seton is placed with considerable advantage in the cheek, when the eyes are much inflamed."—(*Youatt.*)

Founder or inflammation of the foot arises from various causes; excessive exertion, great heat, and particularly when followed by drinking cold water or overloading the stomach in any way, sudden transition from great cold to excessive heat, and change of inflammation from some other part. When the attack is severe and confined to the fore-feet, Youatt recommends removing the shoe and paring the hoof as much as possible, taking 4 quarts of blood from each toe, placing the feet in warm water, and afterwards applying soft poultices of linseed meal to the whole foot, and pastern. If this is ineffectual, take three quarts of blood from each foot the succeeding day. It may then be necessary to blister the foot and coronet. The animal should be kept on green food or light mashes, and allowed to run on grass without labor. An effectual cure has been made by taking off the shoe and applying lard raised to the boiling point, to every part of the foot.

Poison from weeds, sometimes gives to horses ulcerated tongues and lips, and swollen legs and sheath. If there be much inflammation, bleeding should be resorted to, then give daily bran-mashes, with Glauber salts in doses of ½ to 1½ lbs., according to the size of the horse, with half a tea-spoon full

of saltpetre. Washing the ulcerated parts with warm soapsuds, copperas and sugar of lead may follow.

Inflammation of the eyes. Dr. Campbell, of Ohio, recommends for this, shutting up in a dark stable, and feeding on fresh-cut grass and bran-mashes. Bleed freely from the mouth, and give 1½ lbs. Glauber salts, 2 drams nitre, and 15 grains tartarized antimony, dissolved in a bucket of water, which the animal will drink when thirsty. This to be repeated daily till purging is effected. If it fails, bleed from the large veins just below the eye, taking 15 to 20 oz. of blood.

The sting of hornets, bees or snakes, may be relieved by immediate external application of strong spirits of hartshorn; salt and vinegar are also good.

For sprains, take a mixture of 1 oz. sweet oil, 4 oz. spirits hartshorn, ½ oz. oil of thyme, and rub with it frequently. The remedies mentioned below are also effectual for sprains.

For a bruise or blow, apply hot water a long time with wet cloths. Beef brine is an excellent lotion for both sprains and bruises. A veteran among horses, claims that it will almost set a joint, or heal a fracture. Wormwood or tanzy lotions are also good.

Fistula is frequently cured by repeated applications of salt.

Wounds should be washed twice a day with clean, soft water, or with a little Castile soap added, and then rub with whale-oil. This answers for all seasons, keeps off flies, restores the hair, and of the original color.

Galls, or wounds on the back from the saddle, are most effectually removed by white-lead, moistened with sweet-oil or milk. The saddle ought always to fit easily and be well padded, and it should be taken off and the animal's back washed at every baiting.

Shoeing is an importand operation, and should never be attempted but under the supervision of an experienced person; nor ought the shoes to remain so long as to produce contraction of the hoof, which is followed by lameness and corns. They should be re-set as often as every five or six weeks. *Contraction of the foot* is also caused by standing on the dry stable for some days. In this case the hoof should be stopped with fresh cow-manure and clay, or with a thick felt soaked in water, and cut to suit the foot. This is also a good application over night, for horses that have accomplished a hard day's work on a dry road. *Litter* is not objectionable to the feet, if clean and not too damp. Some suppose this the cause of contraction, but it is the reverse. It is besides

of great benefit when shook out for a bed, by inducing the horse to rest himself. He is thus enabled to do more work, and with a less expenditure of food.

Corns.—"In the angle between the bars and the quarters, the horn of the sole has sometimes a red appearance, and is more spongy and softer than at any other part. The horse flinches when this portion of the horn is pressed upon, and occasional or permanent lameness is produced. This disease of the foot is termed corns: bearing this resemblance to the corn of the human being, that it is produced by pressure, and is a cause of lameness, When corns are neglected, so much inflammation is produced in that part of the sensible sole, that suppuration follows, and to that, quittor succeeds, and the matter either undermines the horny sole, or is discharged at the coronet.

"The cure of old corns is difficult; for as all shoeing has some tendency to produce pressure here, the habit of throwing out this diseased horn is difficult to get rid of when once contracted; recent corns, however, will yield to good shoeing.

"The first thing to be done is well to pare out the angle between the crust and the bars. Two objects are answered by this: the extent of the disease will be ascertained, and one cause of it removed. A very small drawing-knife must be used for this purpose. The corn must be pared out to the very bottom, taking care not to wound the sole. It may then be discovered whether there is any effusion of blood or matter underneath. If this is suspected, an opening must be made through the horn, the matter evacuated, the separated horn taken away, the course and extent of the sinuses explored, and introduce into them a *saturated solution of sulphate of zinc*, by means of a small syringe. Place over this dressing the common cataplasm, or the turpentine ointment, and renew the application every twenty-four hours. Three or four such applications complete a cure. Should there be no collection of fluid, the butyr of antimony should be applied over the whole extent of the corn, after the horn has been thinned as closely as possible. The object of this is to stimulate the sole to throw out more healthy horn. In bad cases a bar-shoe may be put on, so chambered, that there shall be no pressure on the diseased part. This may be worn for one or two shoeings, but not constantly, for there are few frogs that would bear the constant pressure of the bar-shoe; and the want of pressure on the heel, generally occasioned by their use, would produce a softened and bulbous state of the

heels, that would of itself be an inevitable source of lameness. Turning out to grass, after the horn is a little grown, first with a bar-shoe, and afterwards with the shoe fettered on one side, or with tips, will often be serviceable. A horse that has once had corns to any considerable extent should, at every shoeing, have the seat of corn well pared out, and the butyr of antimony applied.

"AN OVER-REACH is a tread upon the heel of the coronet of the fore foot by the shoe of the corresponding hind foot, and either inflicted by the toe, or by the inner edge of the inside of the shoe. The preventive treatment is the bevelling, or rounding off, of the inside edge or rim of the hind shoes. The cure is, the cutting away of the loose parts, the application of Friar's balsam, and protection from the dirt.

"There is a singular species of over-reaching, termed FORGING OR CLICKING. The horse, in the act of trotting, strikes the toes of the hind shoes against the fore one. This noise of the clicking is unpleasant, and the trick or habit is not altogether free from danger. It is most frequent in young horses, and is attributable to too great activity, or length of stride in the hind legs. The rider may do something by keeping the head of the horse well up; but the smith may effect more by making the hind shoes of clicking horses short in the toe, and having the web broad. When they are too long, they are apt to be torn off—when too narrow, the hind foot may bruise the sole of the fore one, or may be locked fast between the branches of the fore shoe."—(*Youatt.*)

THE BEARING REIN is a matter of much controversy, some claiming that it should be entirely abolished, while others as strenuously contend for its almost universal use. Nimrod, who is deemed perfectly competent authority, insists on its use with fast roadsters and coach-horses. With team-horses, it may generally be dispensed with, and always should be in ascending hills, as it materially diminishes their capacity for exertion. The fault in its use, is its excessive tightness, and when standing, the horse ought never to be tormented with it.

THE BIT is a frequent cause of injury to the mouth of the horse, fretting and teasing him, and in many cases, inducing permanent injury and viciousness. It should never be made annoying to the horse, beyond the absolute necessity for his proper restraint. *An unruly stud may be controlled* by passing the rein from the ring on the off-side over the head and through the left ring. This gives a purchase to the groom which the horse cannot resist. *Blinds* have for a long time

been fashionable, but in few cases are necessary, while in almost all they are decidedly injurious.

THE STABLE is an important matter connected with the proper management of horses. These should be as much as possible, of an uniform temperature, cool in summer, warm in winter, and always clean, dry, and well ventilated. But no air must be allowed to blow directly upon the animal. The horse is a native of a warm climate, and ought to be well protected against cold. The stable should be neither too light or too dark, nor must the light ever be admitted before the eye of the horse. For judicious and extended arrangement of stables, and management of horses, the inquiring reader is referred to *Stewart's Stable Economy.*

CHAPTER XIX.

THE ASS, THE MULE, AND THE COMPARATIVE LABOR OF WORKING ANIMALS.

THE ASS

Is a native of Arabia, Persia, and the central parts of Asia and Africa. Like the horse, he goes in troops and displays great natural sagacity, activity and courage. Job says, "he scorneth the multitude of the city, neither regardeth the crying of the driver." Like the horse, too, he has from time immemorial, been tamed, and become the faithful servant of man; but unlike him, he is subject to few maladies, is hardy and enduring, and subsists, and even thrives, on coarse and scanty forage. Thus Job says of his natural haunts, "Whose house I have made the *wilderness*, and the *barren land* his dwellings; the range of the *mountains* is his pasture, and he searcheth after *every green thing*." And Xenophon, in his Anabasis, a thousand years later, says of one of the Asiatic deserts through which he passed with the army of Cyrus,

"that it was full of worm-wood; if any other kinds of shrubs or reeds grew there, they had all an aromatic smell; but no trees appeared. Of wild creatures, the most numerous are *wild asses*, which our horses sometimes chased, but the wild asses exceeded them much in speed."

VARIETIES.—The different breeds of asses, are supposed to be quite as numerous as those of the horse. Four distinct races are mentioned in the ancient scriptures. In modern times we find a similar diversity. There are two kinds in Persia, the largest a slow, heavy brute, used only for burdens; the other smaller and more spirited, and used for the saddle. In Egypt, a considerable though less marked difference exists, those near the Delta being inferior to those which are bred in Upper Egypt and Nubia. In Spain, a difference in size and spirit prevails, greater even, than in Persia. The *Zebra* is nearly allied in size, shape and character, to the wild ass, but his untameable ferocity has hitherto effectually bid defiance, alike to the scourges and caresses, the frowns and the favors of man. Arabia produces some of the most spirited and hardy asses, but their size, like that of their horses, is too small for purposes of the greatest utility. The Maltese Jack is by American breeders, deemed the choicest animal from which to propagate. He is evidently of Arabian descent, and possesses all the good qualities of his ancestry, with considerable additional size. We have several varieties, all of which are imported, as there are no natives of the Western Continent. The early importations were principally made from the Azores and Cape de Verd Islands, and were mostly of an inferior character. A superior Maltese Jack was presented to Gen. Washington, in 1787, by La Fayette, and is believed to be the first ever sent to this country. Mr. Custis describes him, as of moderate size, clean limbed, possessing great activity, the fire and ferocity of a tiger, of a dark brown and nearly black, white belly and muzzle, and manageable only by one groom, nor then safely. He lived to a great age. His mules were all active, spirited, and serviceable, and when from stout mares, attained considerable size. A Spanish Jack and Jennet were also presented to Washington about the same time, by the King of Spain. The first is characterized by the same authority, as a huge, ill-shapen animal, near 16 hands high, very large head, clumsy limbs, and to all appearance, little calculated for active service; he was of a grey color, and not much valued for his mules, which were unwieldy and dull. From the Maltese

Jack and Spanish Jennet, which approach the size of the large Spanish Jack, was bred a valuable animal *Compound*, which partook of all the good qualities of the sire, with the weight of the dam. From him descended many of the best mules of Mount Vernon. Many other valuable importations followed these animals, and it is believed, we have for many years, had as fine specimens of the ass as the world affords. Jennets or she asses, are used among us principally for breeding Jacks, and of course are not numerous. They are sometimes, though seldom, bred to the horse. It is difficult to induce the horse to notice them, and the produce, which is called a hinny, is less hardy and useful than the mule. The milk of the she-ass is lighter and more digestible than that of any other animal, and in former times was in great request for invalids.

The ass is occasionally used in the cart, or as a beast of burden. Such as are employed for these purposes, are generally of an inferior kind, and are only used for the lightest work. They may sometimes be seen among the fish-mongers and small vegetable dealers about our city markets, but little larger than a Newoundland dog or Shetland pony, trundling along a light cart with a wheel-barrow load. In ancient times they have been, and in foreign countries even at the present time, they are extensively used. But the moderns have adopted the mule as the proper and almost exclusive substitute for the ass ; and it would show a still greater intelligence and economy, if it much more extensively took the place of the horse.

THE MULE

Is the hybrid produced by the ass with the mare. How early this animal was bred, is uncertain, but we know he was in high repute in the reign of David, near 3000 years ago, for he was rode by Absalom, the favorite prince of Israel, on the field of battle. They have from time immemorial, been bred in various parts of the East, on the borders of the Mediterranean, and throughout Spain, Portugal, and other countries, many of them being of splendid appearance and of fine qualities. In these countries, they are frequently used by the grandees and nobles, and indeed by royalty itself; and however much they may be undervalued elsewhere, when they are finely bred and trained, and richly caparisoned, they exhibit a stateliness and bearing, that few of the highest bred horses can match.

Breeding mules in the United States, was commenced with much spirit in some of the New England states, soon after the American revolution. The object was not to breed them for their own use, but simply as an article of commerce. They were at first shipped exclusively to the West Indies, and afterwards to the South and West, for employment in the sugar mills, and other work on the plantations. Indifferent animals, both as sires and dams, were used at first, as anything which bore the name of mule, then commanded a ready sale. These were necessarily inferior brutes, and viewed with almost universal derision; and being considered the type of their race, a prejudice was excited against them, which more than half a century has not been sufficient to dispel. Among a few thinking men at the North, they have been adopted and made highly useful in the various duties of the farm. They have been largely introduced at the south and west, but principally in the slave states, where the management of the team devolves upon the ignorant and heedless. It is there, and in other and hotter climates, that the superior merits of the mule over the horse as a laboring animal, are peculiarly manifest. In many instances they are indifferently fed, hardly worked, and greatly neglected by their drivers, and yet they sustain themselves for years, in defiance of usage that would annihilate two generations of horses. Their powers have been largely increased and their merits improved, by the introduction of some of the best Maltese and Spanish Jacks, and the use of large, blood mares. The propriety of this course is seen in the value of the product; for while some of the inferior brutes are unsaleable at $50, others of the same age, and reared under the same circumstances of keep and condition, could not be purchased for $150.

The breeding, rearing and management of mules is similar to that of colts. They will be found, as much as horses, to repay generous keep and attention by their increased and rapid growth. But they should not be pampered by high feed, as it not only has a tendency to produce disease, but to form habits of fastidiousness, which materially lessens their economical feeding in after life. The diseases to which mules are subjected which are always few, and if properly managed they will seldom or ever occur, require a treatment like that of horses. *The breeding from mules* has sometimes been questioned, but it has been demonstrated in several instances. Neither the sexual development or propensities

are wanting, but they are seldom indulged with effect. Mr. Kilby of Virginia, states in the Farmer's Register, that a mare mule brought two colts got by a young horse, which they closely resembled. The first was a male, and died, apparently with staggers which no treatment could arrest, at six months old. The second was a female, from the same parents, 16 months younger than the first, marked like the sire, being jet black, excepting a white foot and star in the forehead, and died at a year old, after a two days illness, notwithstanding the utmost care was bestowed upon it. Successful propagation of this hybrid, however, beyond the first cross, seems to be incompatible with the fixed laws of nature.

With a view of encouraging the substitution of mules for a part of the horses now employed in American husbandry, we give the following testimony from experienced individuals of great intelligence and careful observation.

ADVANTAGES OF MULE OVER HORSE LABOR.

The official report of an agricultural committee in South Carolina in 1824, says:—"The annual expense of keeping a horse is equal to his value; that a horse at four years old would not often bring more than his cost; that two mules could be raised at less expense than one horse; is fit for service earlier, and if of sufficient size, will perform as much labor; and if attended to when first put to work, his gait and habits may be formed to suit the owner. Mr. Pomeroy, who used them near Boston for 30 years, and to such an extent as to have had more labor performed by them probably than any person in New England, says:—"I am convinced the small breed of mules will consume less in proportion to the labor they are capable of performing than the larger race, but I shall confine myself to the latter in my comparison, such as stand 14½ to 16 hands, and are capable of performing any work a horse is usually put to. From repeated experiments, I have found that three mules of this description, which were constantly at work, consumed about the same quantity of hay, and only *one-fourth* the provender which was given to two middling size coach-horses, only moderately worked. I am satisfied a large sized mule will not consume more than three-fifths to two-thirds the food to keep him in good order, that will be necessary for a horse performing the same labor. The expenses of shoeing a mule the year round, does not exceed one-third that of the horse, his hoofs being harder, more horny, and so slow in

their growth, that shoes require no removal, and hold on till worn out; and the wear from the lightness of the animal is much less. Mules have been lost by feeding on *cut* straw, and corn *meal*; in no other instance have I known disease in them, except by inflammation of the intestines, caused by the grossest exposure to cold and wet, and excessive drinking cold water, after severe labor, and while in a high state of perspiration. It is not improbable a farmer may work the same team of mules for 20 years without having a farrier's bill presented to him. In my experience of 30 years, I have never found but one mule inclined to be vicious, and he might have been easily subdued while young. I have always found them truer pullers and quicker travellers, with a load, than horses. Their vision and hearing are much more accurate. I have used them in my family carriage, in a gig, and under the saddle; and have never known one to start or run from any object or noise, a fault in the horse that continually causes the maiming and death of numerous human beings. The mule is more steady in his draught, and less likely to waste his strength than the horse, hence more suitable to work with oxen, and as he walks faster, will habituate them to a faster gait. In plowing among crops, his feet being small and following each other so much more in a line, he seldom treads down the ridges or crops. The facility of instructing him to obey *implicitly* the voice of the driver is astonishing. The best plowed tillage land I ever saw, I have had performed by two mules *tandem*, without lines or driver. The mule is capable of enduring labor in a temperature of heat that would be destructive to a horse. Although a large mule will consume something over one-half the food of a horse, yet the saving in shoeing, farrying, and insurance against diseases and accidents, will amount to at least *one-half*. In addition, the owner may rely with tolerable certainty on the continuance of his mule capital for 30 years; whereas the horse owner must, at the end of 15 years, look to his crops, his acres, or a bank for the renewal of his. The longevity of a mule is so proverbial, that a purchaser seldom inquires his age. Pliny mentions one 80 years old; and Dr. Rees, two in England, that reached the age of 70. I saw one performing his labor in a cane-mill in the West Indies, which the owner assured me was 40 years old. I have now a mare-mule 25 years old, that I have had in constant work for 21 years. She has often within a year taken a ton weight in a wagon to Boston, five

miles, and manifests no diminution of her powers. A neighbor has one 28 years old, which he would not exchange for any horse in the country. One in Maryland, 35 years old, is now as capable of labor as at any former period."

Mr. Hood of Maryland, in the American Farmer, estimates the annual expense of a horse for 12 months, at $44, and that of a mule at $22, just half price, and his working age at more than twice that of the horse, and that too after 30 years' experience in keeping both. A correspondent of the Baltimore Patriot, asserts that "Col. John E. Howard had a pair of mules that worked 30 years, after which they were sold to a carter in the city, and performed hard service for several years longer. Many mules 25 years old, and now in this country, perform well. Many have been at hard work for 12 or 15 years, and would now sell for $100 each. They are not subject to the colt's ailments, the glanders, heaves, yellow-water, and colic, like horses; and seldom are afflicted with spavin, ring-bones, or bots, and they will not founder." General Shelby says "he has known mules to travel 10 miles within the hour in light harness, and has himself driven a pair 40 miles in six hours, stopping an hour by the way." Major Shelby of Lexington, sold to Mr. Preston four match mules, for $1,000. They were of course very superior animals, and made elegant coach-horses. Mr. Preston has driven these mules 80 miles in a single day without injury; and they proved a first-rate team for many years. Mr. Ellicott of the Patuxent Furnaces, says:—"Out of about 100 mules at the works, we have not lost on an average one in two years. Bleeding at the mouth will cure them of nearly every disease, and by being turned out on pasture, they will recover from almost every accident. I do not recollect we have ever had a wind-broken one. They are scarcely ever defective in the hoof, and though kept shod, it is not as important as with the horse. Their skin is tougher than that of a horse, consequently, they are not as much worried by flies, nor do they suffer so much with the heat of summer."

To the foregoing testimony may be added that of the late Judge Hinckley of Northampton, Massachusetts; a shrewd and close observer through a long life, reaching to 84 years. He bred mules at an early day, and always kept a team of them for his farm work, much preferring them to horses for this purpose, after an experience of 50 years. He had a pair nearly 30 years old, which, in light pasturage in summer,

and with a moderate supply of hay and very little grain in winter, and no grooming, performed all the drudgery, though he kept his stable full of horses besides. They outlived several successive generations of horses, and though the latter were often sick and out of condition, the mules never were. One from his stock, 45 years old, was sold for the same price paid for a lot of young mules, he being at that mature age, perfectly able to perform his full share of labor.

For the caravans that pass over the almost inaccessible ranges which form the continuation of the Rocky Mountains, and the extensive arid plains that lie between and west of them, on the route from Sante Fe to California, mules are the only beasts of burden used in these exhausting and perilous adventures. Their value may be estimated from the comparative prices of mules and horses; for while a good horse may be bought for $10 to $20, a good mule is worth $50 to $75. Dr. Lyman, who recently passed through those regions, informs us that their caravan left Santa Fe with about 150 mules, 15 or 20 horses, all beasts of burden, and two choice blood horses, belonging to an English gentleman, which were led and treated with peculiar care. On the route, all the working-horses died from exhaustion and suffering; the two bloods that had been so carefully attended, but just survived; yet of the whole lot of mules, but eight or ten gave out. A mule 36 years of age was as hardy, strong, enduring, and performed as hard labor, as any one in the caravan. When thirst compelled them to resort for successive days to the saline waters, which are the only ones furnished by those dry and sterile plains, the horses were at once severely, and not unfrequently, fatally affected; while the mules, though suffering greatly from the change, yet seldom were so much injured as to require any remission of their labor. The mules sent to the Mexican possessions from our western states, Arkansas, Missouri, Tennessee, and Kentucky, are considered of much more value than such as are bred from the native (usually wild) mares. The difference probably arises, in part, from the Mexicans using Jacks inferior to those so highly improved of late years by our western citizens. Mare mules are estimated in those regions at one-third more than horse mules. The reason assigned for this is, that after a day's journey of excessive fatigue, there is a larger quantity of blood secreted in the bladder, which the female, owing to her larger passage, voids at once

and without much apparent suffering, while the male does not get rid of it, frequently, till after an hour of considerable pain. The effect of this difference is seen in the loss of flesh and strength in the male, to an extent far beyond that of the female. The universal method of reducing refractory mules in the northern Mexican possessions, is for the person to grasp them firmly by the ears, while another whips them severely on the fore-legs and belly.

Estimated annual saving to the United States from the employment of mules in the place of horses.—To sum up the advantages of working m.les over horses, we shall have as advantage: 1. They are more easily, surely, and cheaply raised. 2. They are maintained, after commencing work, for much less than the cost of keeping horses. 3. They are are not subject to many of the diseases of the horse, and to others, only in a mitigated degree, and even these are easily cured in the mule. 4. They attain a greater age, and their average working years are probably twice that of the horse.

In 1840, there were reported to be 4,335,669 horses and mules in the Union, no discrimination having been made between them. Suppose the total number at the present time is 4,650,000, and that of these 650,000 are mules, and if we deduct or e-fourth supposed to be required fro the purposes of breed, fancy horses, &c., we shall then have 3,000,000 horses, whose places may be equally well supplied by the same number of mules. We have seen that Mr. Hood of Maryland, estimates the expense of a working horse at $44 per annum, (not an over estimate for the Atlantic states,) while that of the mules is $22. The difference is $22, which it is proper to reduce to meet the much lower rate of keeping at the west. If we put the difference at $10, we shall find the saving in the keep, shoeing, farriery, &c., by substituting mules for the 3,000,000 horses that can be dispensed with, will be $30,000,000 per annum. But this is not all. The working age of the horse will not exceed an average of eight years, while that of the mule is probably over 16. To the difference of keep then, must be added the annual waste of the capital invested in the animal. A mule is more cheaply raised to working age than a horse, but allowing them to cost equally, we shall have the horse exhausting one-eighth or three-twenty-fourths of his capital annually for his decay, when the mule is using up but one-sixteenth; and if we allow $48 as the first cost of both ani-

mals, we shall find the horse wasting $6 annually for this item, while the mule deteriorates but $3, making an additional item of $9,000,000 more; and an aggregate of $39,000,000 as the annual saving to the United States by substituting good mules for three-fourths of the horses now used in this country. When will our farmers have the good sense to make this change? It may be fairly answered, when they shall prefer utility, and interest, and a just taste, to a diseased fancy; for though we admit the superiority in appearance of the race of horses over mules, we deny that a bad horse looks better or even as well as a good mule; and with the same keep and attention, a good mule will outwork and outlook most horses of any breed.

THE COMPARATIVE ECONOMY OF HORSE AND OX LABOR.—This is a question which has been often discussed, and when with candor, the conclusion generally has been in favor of ox labor. The different employments, the variety of situation, the season and the kind of stock reared on the farm, are all questions which should be fully considered in arriving at their true comparative advantages. Most farmers would find it for their interest to keep teams of each, where there is employment for more than one; or if this be not the case, the preference should be given to that which is best suited in all respects to their particular position. If work upon the road is required, a horse team will generally be best. Their superiority will consist principally in their greater speed, for even with a heavy load, they will be able to trot occasionally, and when driven without it, they may increase their pace to nearly double the natural gait of the ox. This will amount to a large annual saving in the time of the driver when steadily employed. The same is true when removing manure or crops on the farm to remote distances, over a smooth surface, which admits of trotting with the empty wagon. Harrowing ought always to be done with a quick team, as a violent stroke of the teeth, breaks the clods, and pulverizes the earth much better than when slowly dragged along. But we assume in this comparison, that oxen shall not only be well adapted to their work by their natural formation like the Hereford, the Devon and others equally good, but that they be also well broke, well managed, accustomed to quick movements, and as well fed and looked after as horses. We shall then find their walk equal to a quick horse team, and that in this case, the horse will have no advantage over the ox in harrowing. For plowing, the

teams are on a par, as a good ox team will do as much in a day in cool weather, as horses. Where the loads can be tipped, as in unloading manure in the field, or roots through a scuttle, or in heaps, the ox cart, or the single two-wheel horse-cart is best, as all the labor of throwing out by hand is avoided.

The situation of the farm may materially affect this estimate. In a warm climate, horses, and more especially mules, would be more serviceable than oxen, as they are capable of enduring much greater heat with impunity. If the farm be small and convenient to market, the labor may in general, be best accomplished by oxen, as little travelling will be required. So too, if the land be stony or rough, the plowing and harrowing will be more kindly and patiently done by oxen than by spirited horses. Other considerations will suggest themselves as affecting the comparative economy of this labor.

The time of work is to be fully considered. If much and heavy work be required in summer, as is often the case in plowing extensive wheat farms, horses are to be preferred; yet if the ox-team be started at early dawn, and worked briskly four or five hours, and then turned out to rest with a supply of suitable food, they may again commence when the extreme heat has abated, and accomplish a day's work that few horses will exceed. During the season of muddy roads, the horse with his broad, compact foot and longer leg, has a decided advantage over the ox. If the ox draws by the yoke (which on the whole is the best mode,) he is liable to a sore neck when working in wet or snowy weather, and at such times he is over matched by his competitor. This is partially remedied by applying a decoction of white or yellow oak bark.

The kind of stock raised on the farm has an important bearing on this question. Some farms are devoted to rearing horses, and some exclusively to rearing cattle. These sometimes remain on hand after they are fit for market, from the want of a profitab'e demand. They can then be employed not only without injury, but in consequence of the thorough training thus secured, with positive benefit to their future value. Even if intended for the shambles, the well developed ox may advantageously be put to light work at three, after which, it may be gradually increased till he is six or eight, and during all this time he will be improving, and after doing an early spring's work, he may then be turned on to

good pasture, and if followed with proper stall feeding, he will in the latter part of the winter or spring, yield a tender, better flavored and more profitable carcass, than can be procured by any other mode of fattening.

The first cost of oxen is less than that of horses, and they are at all times cheaply reared on the coarser herbage of the farm. The expense of working-gear, tackle and shoeing, is much less than with horses. They are subject to fewer diseases, and these are more within the reach of ordinary medicines. The cost of food is also less, and while the horse is depreciating, the ox is increasing in value till eight or nine years old. Accidents are less frequent with oxen, from their slower movements; and when they occur, the ox may be turned out to fatten, and still be worth as much for this purpose as for the yoke. A permanent injury to the horse, is perhaps a total loss of the beast, with a large farrier's bill in adddition, for which there is nothing to liquidate it but the hide. The small farmer can make out a most serviceable team, by putting a single horse before a yoke of cattle. If well trained, they will soon accommodate themselves to each others pace, and work as advantageously together, as an entire team of either animals would do alone. Bulls are frequently put to the draught, and when they have not other services that fully test their powers, they cannot be better employed. Heifers and cows are sometimes worked, but hitherto they have not been used to any extent in this country. In the absence of other animals, they might perform light work to advantage, but severe labor would stint their growth or impair their milk beyond the benefit derived from it. The *spayed heifer* is an exception to the foregoing remark, and by many, is esteemed even more useful than an ox of equal weight. We have no definite statements of the comparative money value of the labor of oxen and horses. But in England, repeated trials have been made, and while some have found no advantage in the employment of oxen over horses, others have proved them decidedly superior. One Anglesey farmer, found in an experience of three years, with 12 horses and 20 oxen, which accomplished an equal amount of work, that he had saved by the latter 236 pounds, or nearly $1180. This result proves the subject to be one of sufficient importance, to justify the closest investigation of every farmer to determine for himself, the comparative value of ox, horse or mule labor.

CHAPTER XX.

SWINE.

The hog is a cosmopolite of almost every zone, though his natural haunts, like those of the hippopotamus, the elephant, the rhinoceros and most of the thick-skinned animals, are in warm climates. They are most abundant in China, the East Indies and the immense range of Islands which extend over the whole Southern and Pacific Oceans; but they are also numerous throughout Europe, from its Southern coast to the Russian dominions within the Arctic. In the United States, they have been an object of attention since its earliest settlements, and whenever a profitable market could be found for pork abroad, it has been exported to the full extent of the demand. For 20 years following the commencement of the general European wars, soon after the organization of our National government, it was a comparatively large article of export; but since then, exports to any extent, have not been justified, till within the last two years, since which, a material reduction in the British import duty on pork, lard, hams, beef, &c., has again brought it up as a prominent article of commerce with that country. The recent use which has been made of the carcass in converting it into lard oil, has still further increased its consumption. Swine are reared in every part of the Union, and when properly managed, always at a fair profit. At the extreme north, in the neighborhood of large markets, and on such of the southern plantations as are particularly suited to sugar or rice, they are not profitable, beyond the number required for the consumption of the coarse or refuse food produced. While pork remains at a moderate price, it can only be advantageously raised on a large scale, on good soils, as it is such only that yield heavy crops of grain, roots, &c. which are essential to fattening it. Swine are profitable in connexion with a dairy or orchard, as with little additional food besides what is thus afforded, they

can be put into good condition for the butcher. It is on the rich bottoms, and other lands of the west, where Indian corn is raised in profusion, and at small expense, that they can be reared in the the greatest numbers and yield the largest profit. The Sciota, Miami, Wabash, Illinois and other vallies; and extensive tracts in Kentucky, Tennessee, Missouri, and some adjoining states, have for many years, taken the lead in the production of swine; and it is probable their climate and soil, which is peculiarly suited to their rapid growth, as well as that of their appropriate food, will enable them forever to remain the leading pork producers of the North American continent.

THE BREEDS OF SWINE cultivated in this country are numerous, and like our native cattle, they embrace many of the best, and a few of the worst to be found among the species. Great attention has for many years, been paid to their improvement in the eastern states, and nowhere are there better specimens than in many of their herds. This spirit has rapidly extended westward and southward, and among many of the intelligent farmers, who make them a leading object of attention, on the rich corn grounds of the west, the swine have attained a considerable degree of excellence. This does not consist in the introduction and perpetuity of any distinct races, so much as in the breeding up to a desirable size and aptitude for fattening, from such meritorious individuals of any breed or their crosses, as come within their reach. The *Byefield* some 30 years ago, was a valuable hog in the Eastern states, and did much good among the species generally. They are white, with fine curly hair, well made and compact, moderate in size and length, with broad backs, and at 15 months, attaining some 300 to 350 lbs. nett. The *Bedford* or *Woburn* is a breed originating with the Duke of Bedford, on his estate at Woburn, and brought to their perfection probably, by judicious crosses of the China hog, on some of the best English swine. A pair was sent by the Duke to this country, as a present to Gen. Washington, but they were dishonestly sold by the messenger in Maryland, in which state and Pennsylvania, they were productive of much good at an early day, by their extensive distribution through different states. Several other importations of this breed have been made at various times, and especially by the spirited masters of the Liverpool packet ships, in the neighborhood of New-York. They are a large, spotted animal, well made and inclining to early maturity and fattening. They are an exceedingly valuable hog, but are

nearly extinct both in England and this country, as a breed. The *Leicesters* are a large, white hog, generally coarse in the bone and hair, great eaters and slow in maturing. Some varieties of this breed, differ essentially in these particulars, and mature early on a moderate amount of food. The crosses with smaller compact breeds, are generally thrifty, desirable animals. *Other large breeds* deserving commendation in this country, are the large *Miami white*, the *Yorkshire white* and the *Kenilworth*, each frequently attaining when dressed, a weight of 600 to 800 lbs. The *Chinese* is among the smaller varieties, and without doubt, is the parent stock of the best European and American swine. They necessarily vary in appearance, size, shape and color, from the diversity in the style of breeding, and the various regions from which they are derived. But all the Chinese seem to have these properties in common. They are fine-boned, short and very compact, with bellies almost touching the ground, light head and ears, fine muzzle, of great docility and quietness, small feeders and producing much meat for the quantity of food consumed. From the rapidity with which generations of this animal are multiplied, the variety of other breeds on which they are crossed, and the treatment to which they are subjected, it is not surprising that their descendants should rapidly assume distinct features. From these, we have not only a strong mixture of blood in the best class of large breeds, but in such of the smaller as have any pretensions to merit, they constitute the greater part of the improvement. Such are the *Neapolitan*, the *Essex half-black*, the *Grass breed* and some others.

The *Berkshires* are an ancient English breed, formerly of large size, slow feeders, and late in maturing. Their color was a buff or sandy ground with large black spots, and the feet, lower part of the legs and tuft on the tail, buff. The latter color has given place, in most of the modern race, to white in the same parts. This variation, with the more important ones of early maturity and good feeding properties, are by Professor Low, ascribed to a Chinese cross, which has added the only characteristic in which they were before deficient. They were first introduced and reared as a distinct breed in this country, by Mr. Brentnall, of Orange Co., and Mr. Hawes, of Albany, N. Y. In their hands, and those of other skillful breeders, their merits were widely promulgated. No other breeds have been so extensively diffused in the United States, within comparatively so brief

a period, as the Berkshires, since 1832. They have produced a marked improvement in many of our former races. They weigh variously, from 250 to 400 lbs. nett, at 16 months, according to their food, and style of breeding; and some full-grown have dressed to more than 800 lbs. They particularly excel in their hams, which are round, full and heavy, and contain a large proportion of lean, tender and juicy meat of the best flavor. None of our improved breeds afford long, coarse hair or bristles; and it is a gratifying evidence of our decided improvements in this department of domestic animals, that our brush-makers are under the necessity of importing most of what they use from Russia and Northern Europe. This improvement is manifest not only in the hair but in the skin, which is soft and mellow to the touch; in the finer bones, shorter head, with upright ears, dishing face, delicate muzzle and mild eye; and in the short legs, low flanks, deep and wide chest, broad back and early maturity.

Breeding.—Swine should not be allowed to breed before 12 or 15 months old, unless the animals are large and coarse, when they may be put to it somewhat younger. Not only choice individuals, but such as are well descended, should be selected for the purpose of breeding. The sow should be in good condition, but not fat, nor approaching to it, and a proper degree of exercise is essential to the development of the fœtus and the health of the parent; for which reason she should have an extended range connected with her pen. The sow goes with young about 114 days. A week before her time comes round, a comfortable, quiet place should be prepared for her under cover, and well protected from cold, if the weather be severe, or if warm, a range in a pasture with an open shed to retire to, is sufficient. Too much litter for bedding must be avoided, and no change or disturbance of the sow permitted till two or three weeks after pigging, as the restlessness thereby produced may result in the loss of the pigs. The sow should be fed only with a small quantity of the lightest food or thin gruel, for two or three days, nor put on full feed for a week. If inclined to eat her pigs, she should be fed two or three times with raw pork or fresh meat. The pigs may be taught to crack oats or soaked corn after three weeks, and if provided with a trough inaccessible to the dam, they will soon learn to feed on milk and other food, preparatory to weaning. This may take place when they are 8 or 10 weeks old, and to prevent injury to the sow, let one or two remain with her a few days

longer, and when finally removed, if her bag appears to be full, they may be allowed to drain the milk after 20 or 30 hours. The sow should be restricted to a light, dry diet for a few days.

RAISING, FEEDING AND FATTENING.—There are but two objects in keeping swine,—for breeding, and for slaughter,—and their management is consequently simple. Those designed for breeding should be kept in growing condition, on light food, and have every advantage for exercise. Such as are destined exclusively for fattening, ought to be steadily kept to the object. It is the usual practice in this country, to let spring pigs run at large for the first 15 months, with such food as is convenient, and if fed at all, it is only to keep them in moderate growth till the second autumn. They are then put up to fatten, and in the course of 60 or 90 days, are fed off and slaughtered. During this brief period, they gain from 50 to 100 per cent. more of dressed weight, than in the 15 or 18 months preceding; nor even then do they yield a greater average weight, than is often attained by choice, thrifty pigs, which have been well fed from weaning to the age of 7 or 8 months. Three pigs of the Bedford breed, when precisely 7½ months old, dressed 230, 235 and 238½ lbs. Two of the Berkshire and Leicester breeds, at 9 months, dressed 304 and 310 lbs. Three others of the Berkshire and Grass breeds, 7 months and 27 days old, weighed 240, 250 and 257 lbs. nett. Innumerable instances could be adduced of similar weights, gained within the same time, with a good breed of animals under judicious treatment. We have no one accurate account of the food consumed, so as to determine the relative profit of short or long feeding. But that an animal must consume much more in 18 or 20 months to produce the same quantity of dressed meat, which is made by others of 7 or 8 months, does not admit of a doubt. We have seen that an ox requires but little more than double the quantity of food to fatten, that is necessary for supporting existence. If we apply this principle to swine, and state the quantity of food which will fatten the pig rapidly, to be three times as great as for the support of life, we shall find that the pig will fatten in 7 months, on the same food he would consume to keep him alive for 21. This is based on the supposition that both animals are of equal size. But the pig that matures and is slaughtered at 7 months, has only a moderate capacity for eating. During the early stages of his growth, his size and the consequent incapacity of the

digestive organs, prevent the consumption of the same quantity which the larger animal requires; and his accumulating fat, his limited respiration, consequent upon the compression of his lungs, and his indisposition to exercise, all conspire to keep the consumption of food within the smallest possible limit. This result, in the absence of any experiment, must be conjectural entirely; but we believe that experiments will show that of two thrifty pigs from the same litter, one of which is properly fed to his utmost capacity for 7 months, and the other fed with precisely double the quantity of similar food for 21 months, the first will yield more carcass and of a better and more profitable quality than the latter, which has consumed 100 per cent. the most. The food is only one item in this calculation. The oldest requires the most attention, is liable to more accidents and disease, besides the loss of interest. We are necessarily forced to the conclusion, that by far the cheapest mode of wintering pigs is in the pork-barrel. We can readily anticipate one objection to this practice, which is the want of food at this season of the year to fatten them. This can be obviated by reserving enough of the previous year's grain, to keep the animal in a rapidly thriving state till the next crop matures sufficiently to feed.

In the rich corn regions, on its beginning to ripen, as it does in August, the fields are fenced off into suitable lots, and large herds are successively turned into them, to consume the grain at their leisure. They waste nothing except the stalks, which, in that region of plenty, are not considered of much value, and they are useful as manure for succeeding crops, and whatever grain is left by them, leaner droves which follow, will readily glean. Peas, early buckwheat, and apples, may be fed on the ground in the same way. But we believe there is an improvement in the character of the grain from a few months' keeping, which is fully equivalent to the interest of the money and cost of storage. If fattened early in the season, they will consume less food to make an equal amount of flesh that in colder weather, they will require less attention, and generally early pork will command the highest price in market.

It is most economical to provide the swine with a fine clover pasture to run in during the spring and summer, and they ought also to have access to the orchard, to pick up all the unripe and superfluous fruit that falls. They should also have the wash of the house and the dairy, to which add meal, and sour in large tubs or barrels. Not less than one-third,

and perhaps more, of the whole grain fed to swine, is saved by grinding and cooking or souring. Yet care must be observed that the souring be not carried so far as to injure the food by putrefaction. A mixture of meal and water, with the addition of yeast or such remains of a former fermentation, as adhere to the side or bottom of the vessel, and exposure to a temperature between 68° and 77° will produce immediate fermentation. In this process there are five stages. The *saccharine*, by which the starch and gum are converted into sugar; the *vinous*, which changes the sugar into alcohol; the *mucilaginons*, sometimes taking the place of the vinous, and occurs when the sugar solution, or fermenting principle is weak, producing a slimy, glutinous product; the *acetic*, forming vinegar, and the *putrefactive*, which destroys all the nutritive principles and converts them into a poison. The precise point in fermentation when the food becomes most profitable for feeding, has not yet been satisfactorily determined; but that it should stop short of the putrefactive, and probably the acetic, is certain.

The roots for fattening animals ought to be washed and steamed or boiled, and when not intended to be fermented, the meal ought always to be scalded with the hot roots. Such a quantity of salt as will not scour, may be added to every preparation for swine. Potatos are the best roots for swine; then parsneps, orange or red carrots, white or Belgian, sugar beets, mangold wurzel, ruta-bagas, and the white turnips, in the order mentioned. The nutritive properties of turneps are diffused through so large a bulk, that we doubt if they can ever be fed to fattening swine with advantage; and they will barely sustain life when fed to them uncooked. There is a great loss in feeding roots to fattening swine, without cooking. When unprepared grain is fed, it should be on a full stomach, to prevent imperfect mastication, and the consequent loss of food. It is better indeed to have it always before them. The animal machine is an expensive one to keep in motion, and it should be the object of the farmer, to put his food in the most available condition, for its immediate conversion into fat and muscle. Swine ought to be kept perfectly dry and clean, and provided with a warm shelter, to which they can retire at pleasure. This will greatly hasten the fattening and economize the food. A hog ought to have three apartments, one each for sleeping, eating, and evacuations, of which the last ought to occupy the lowest, and the first the highest level, so that nothing shall be drained, and

as little carried into the first two as possible. They must be regularly fed three times a day, and if there is a surplus, it must be removed at once. If they are closely confined in pens, give them as much charcoal twice a week as they will eat. This corrects any tendency to disorders of the stomach. Rotten wood is an imperfect substitute for charcoal. Graves, scraps or cracklings, as they are variously called, the residuum of rough lard or tallow after expressing the fat, are a good change and an economical food. Some animal food, although not essential, is always acceptable to swine. When about to finish them off, many feed for a few weeks on hard corn. This is proper when slops or indifferent food has been given, and meal cannot be conveniently procured; but when fattened on sound roots and meal, it is a wasteful practice, as the animal thus falls behind his accustomed growth. It is better to give him an occasional feed of the raw grain, for a change, and to sharpen his appetite.

The products furnished by the carcass of swine are numerous. Every part of the animal is used for food, and it admits of a far greater variety of preparation for the table, than any other flesh. From the remotest antiquity to the present time, and in every grade of barbarous and civilized life, it has been esteemed as one of the choicest delicacies of the epicure. *Lard oil* has within a few years, given to pork a new and profitable use, by which the value of the carcass is greatly increased. At some of the large pork-packing depots of the west, one-third of the whole quantity has been thus disposed of. This has withdrawn a large amount of pork from the market, and prevented the depression which must otherwise have occurred. Where the oil is required, the whole carcass, after taking out the hams and shoulders, is placed in a tub having two bottoms, the upper one perforated with holes, on which the pork is laid, and then tightly covered. Steam at a high temperature is then admitted into the tub, and in a short time, all the fat is extracted and falls upon the lower bottom. The remaining mass, is bones and scraps. The last is fed to pigs, poultry or dogs, or affords the best kind of manure. The bones are either used for manure, or are converted into animal charcoal, worth about three cents per lb., which is valuable for various purposes in the arts. When the object is to obtain lard of a fine quality, the animal is first skinned, and the adhering fat carefully scraped off. The oily, viscid matter of the skin is thus avoided. When tanned, the skin makes a valuable leather.

An aggregate weight of 1790 lbs. from four well-fattened animals, after taking out the hams and shoulders, say about 400 lbs., gave within a fraction of 1200 lbs. of the best lard.

Stearine and Oleine.—Lard and all fatty matters consist of three principles, of which stearine contains the stearic and margaric acids, both of which when separated, are solid and used as inferior substitutes for wax or spermaceti candles. The other, oleine, is fluid at a low temporature, and in American commerce, is known as lard oil. It is very pure and extensively used for machinery, lamps and most of the purposes for which olive or spermaceti oils are used.

Curing hams and pork.—After dressing, the carcass should be allowed to hang till perfectly drained and cool, when it may be cut up and salted. The usual way is to pack the pork in clean salt, adding brine to the barrel when filled. But it may be dry salted, by rubbing it in thoroughly on every side of each piece, with a strong leather rubber, firmly secured to the palm of the right hand. The pieces are then thrown into heaps and sprinkled with salt, and occasionally turned till cured; or it may at once be packed in dry casks, which are occasionally rolled to bring the salt into contact with every part. *Hams and shoulders* may be cured in the same manner, either dry or in pickle, but with differently arranged materials. The following is a good pickle for 200 lbs. Take 14 lbs. of Turk Island salt; ½ lb. of salt petre; 2 qts. of molasses, or 4 lbs. of brown sugar, with water enough to dissolve them. Bring the liquor to the scalding point, and skim off all the impurities which rise to the top. When cold, pour it upon the ham, which should be perfectly cool but not frozen, and closely packed; and if not sufficient to cover it, add enough pure water for this purpose. Some extensive packers in Cincinnati and elsewhere, who send choice hams to market, add pepper, allspice, cinnamon, nutmegs or mace and cloves. The hams may remain six to eight weeks in this pickle, then hung up in the smoke-house, with the small end down, and smoked from 10 to 20 days, according to the quantity of smoke. The fire should not be near enough to heat the hams. In Holland and Westphalia, the fire is made in the cellar, and the smoke carred by a flue into a cool dry chamber. This is undoubtedly the best method of smoking. The hams should at all times be dry and cool, or their flavor will suffer. Green sugar-maple chips, are best for smoke; next to them are hickory, sweet birch, corn cobs, white ash, or beech. The smoke house is the best place to keep hams

till wanted. If removed, they should be kept cool, dry and free from flies. A canvass cover for each, saturated with lime, which may be put on with a white-wash brush, is a perfect protection against flies. When not to be kept long, they may be packed in dry salt, or even in sweet brine without injury. A common method is to pack in dry oats, baked saw-dust, &c.

DISEASES OF SWINE.

Mortifying as the fact may be to human pride, it is nevertheless certain, that the internal arragements, the viscera, digestive organs, omniverous propensities, and the general physiological structure of the hog and the bear, more nearly resemble man, than any other animal. Many of their diseases may therefore be expected to be a modification of those of the human species, and require a similar treatment. Swine are parculiarly liable to colds, coughs and pulmonary affections; to cutaneous disorders, and that other frequently fatal human disease, the measles. Like most other evils, prevention of disease in swine, is more easy and economical than cure. A dry warm bed, free from winds or storms, and suitable food, will most effectually prevent any injuries, or fatal attacks. The hog has little external covering to protect him against cold. Nature has provided this immediately within the skin, in the deep layer of fat, which surrounds the full, plump hog. Fat is one of the best non-conductors of heat, and the pig which is well fed, bids defiance to the intense cold, which would produce great suffering and consequent disease, in the ill conditioned animal. By the observance of a proper medium between too much fat or lean, for the store or breeding swine, and providing them with comfortable beds and proper feed, almost all diseases will be avoided.

For coughs and inflamation of the lungs, bleeding should immediately be resorted to, after which give gentle purges of castor oil, or Epsom salts; and this should be followed with a dose of antimonial powders; 2 grains, mixed with half a dracham of nitre.

For costiveness or loss of appetite, sulpher is an excellent remedy, given in a light mess.

Itch may be cured by anointing with equal parts of lard and brimstone. Rubbing posts, and a running stream to wallow in are preventives.

The kidney worm is frequently fatal, and always produces weakness of the loins and hind legs, and generally,

entire prostration. A pig thus far gone, is hardly worth the trouble of recovering, even where practicable. Preventives are general thrift, a range, in a good pasture, and a dose of half a pint of wood ashes every week or fortnight in their food. A small quantity of salt petre, spirits of turpentine, or tar will affect the same object. When attacked, apply spirits of turpentine to the loins, and administer calomel carefully; or give half a table spoonful of copperas daily for one or two weeks.

Blind Staggers, generally confined to pigs, manifests itself in foaming at the mouth, rearing on their hind legs, champing and grinding their teeth and apparent blindness. The proper remedies are bleeding and purging freely, and these frequently fail. Many nostrums have been suggested, but few are of any utility. It is important to keep the issues on the inside of the fore legs, just below the knee, thoroughly cleansed. The most convenient mode of bleeding, is from an artery just above the knee, on the inside of the fore-arm. It may be drawn more copiously from the roof of the mouth. The flow of blood may usually be stopped, by applying a sponge or cloth with cold water.

The diseases of swine, though not numerous, are formidable, and many of them soon become fatal. They have not been the subject of particlar scientific study, and most of the remedies applied, are rather the result of casual or hap-hazard suggestion, than of well-digested inference, from long continued and accurate observation.

CHAPTER XXI.

POULTRY.

Choice varieties of fowls, add a pleasant feature to the farm premises. They engage the attention and sympathy of the juvenile farmers, and the time bestowed in the poultry yard, keeps them from mischief, is an agreeable and salutary relief for toil and study, and elicits the taste, the judgment, and the kindlier feelings of humanity, which are to be matured in the future accomplished breeder. When properly managed, poultry are a source of considerable profit, yielding more for the food they consume, than any other stock, although their value is not often considered. The agricultural statistics of the United States, for 1839, give us over $12,000,000 in poultry, and it probably exceeds $15,000,000 at the present time. It is estimated by McQueen, that the poultry of England exceeds $40,000,000, and yet McCulloch says, she imports 60,000,000 eggs annually from France,—McQueen states it at near 70,000,000; and from other parts of the continent, 25,000,000; besides 80,000,000 imported from Ireland. Poultry then ceases to be an unimportant object of agricultural attention, and assumes its appropriate place among the other staples of the farmer.

HENS

Are the most numerous and profitable, and the most generally useful of the feathered tribe. The hen is peculiarly an egg-producing bird. She has the same predisposition for laying, that the cow has for secreting milk. Some breeds are better adapted for this object than others; but in all that have ever come within our notice, the proper food and circumstances are alone wanting, to produce a reasonable quantity of eggs. The egg consists of three distinct parts; the shell, the white, and the yolk. A good-sized egg will weigh 1,000 grains, of which about 107 are shell, 604 are white,

and 289 are yolk. Of the shell, 97 per cent. is carbonate of lime, 1 per cent. phosphate of lime and magnesia, and 2 per cent. albumen. The white consists of 12 per cent. of albumen, 2.7 of mucus, 0.3 of salts, and 85 of water. The yolk has about 17.4 per cent. of albumen, 28.6 of yellow oil, 54 of water, with a trace of sulphur and phosphorus. The above are the constituents of eggs, which have been formed when the bird has free access to the various articles, which constitute her natural food. But they vary with circumstances. When full fed and denied all access to lime, she will form an egg without the shell, and deliver it enclosed in the membrane or sack which always surrounds the white, when covered by the shell. When scantily fed, they will frequently lay; but from a deficiency of nutriment, the egg will be meagre and watery, and possess but a small portion of the nutritious qualities peculiar to them. To produce the largest number of good eggs, several conditions are important; and they must especially have an abundance of the right kind of food. This is the most readily obtained in part from animal food. In warm weather, when they have a free range, they can generally supply their wants in the abundance of insects, earth worms, and other animal matters within their reach. The large proportion of albumen contained in their eggs, requires that much of their food should be highly nitrogenized, and when they cannot procure this in animal matter, it must be given in grains containing it.

If to the usual qualities of hens, a breed of peculiar elegance, of graceful forms, and beautiful plumage, be added, together with entire adaptation to the economical purposes required, good layers, and good carcass, we have a combination of utility, luxury, and taste in this bird, which should commend them as general favorites. They can every where be kept with advantage, except in dense cities. A hen that costs a shilling or two, if provided with a suitable range, will consume 30 or 40 cents worth of food, and produce from 80 to 150 eggs per annum, worth two or three times the cost of feed and attention.

The food of hens may consist of different kinds of grain, either broken, ground, or cooked; roots, and especially boiled potatoes, are nutritious and economical; green herbage, as clover and many of the grains, chickweed, lettuce, cabbage, &c., will supply them with much of their food, if fresh and tender. Though not absolutely essential to them, yet nothing contributes so much to their laying, as unsalted, animal food.

This is a natural aliment, as is shown by the avidity with which they pounce on every fly, insect, or earth-worm which comes within their reach. It would not of course pay to supply them with valuable meat, but the blood and offal of the slaughter houses, refuse meal of all kinds, and especially the scraps or cracklings to be had at the melters' shops, after soaking for a few hours in warm water, is one of the best and most economical kinds of food. Such with boiled meal is a very fattening food. Grain is at all times best for them when cooked, as they will lay more, fat quicker, and eat much less when it is fed to them in this state; and it may be thus used unground, with the same advantage to the fowls, as if first crushed, as their digestive organs are certain to extract the whole nutriment. All grain is food for them, including millet, rice, the oleaginous seeds, as the sun-flower, flax, hemp, &c. It is always better to afford them a variety of grain, where they can procure them at their option, and select as their appetite craves.

They are also fond of milk, and indeed scarcely any edible escapes their notice. They carefully pick up most of the waste garbage around the premises, and glean much of their subsistence from what would otherwise become offensive, and by their destruction of innumerable insects and worms, they render great assistance to the gardener. Of course their ever-busy propensity for scratching, is indiscriminately indulged just after the seeds have been planted and while the plants are young, which renders it necessary that they be confined in some close yard for a time; yet this should be as capacious as possible. Their food is better when given to them warm, not hot; and there should always be a supply before them to prevent gorging, which is better to be placed on shelves or suspended boxes or hoppers, which are variously and cheaply constructed, to keep it clean and out of the reach of rats. Besides their food, hens ought to be at all times abundantly supplied with clean water, egg or pounded oyster shells, old mortar or slaked lime. If not allowed to run at large, where they can help themselves, they must also be furnished with gravel to assist their digestion; and a box or bed of ashes, sand and dust, is equally essential to roll in for the purpose of ridding themselves of vermin.

THE HEN-HOUSE may be constructed in various ways to suit the wishes of the owner, and when tastefully built, it is an ornament to the premises. It should be perfectly dry

throughout, properly lighted, and capable of being made tight and warm in winter, yet afford all the ventilation desirable at any season. In this, arrange the nests in boxes on the sides, in such a manner as to humor the instinct of the hen for concealment when she resorts to them. When desirable to set the hen, these nests may be so placed as to shut out the others, yet open into another yard or beyond the enclosure, so that they can take an occasional stroll and help themselves to food, &c. This prevents other hens laying in their nests, while setting, and may be easily managed, by having their boxes placed on the wall of the building, with a movable door made to open on either side at pleasure. Hens will lay equally well without a nest-egg, but when broken up, they ramble off and form new nests, if they are not confined. They will lay if kept from the cock, but it is doubtful if they will thus yield as many eggs. Hens disposed to set at improper times, should be dismissed from the common yard, so as to be out of reach of the nests, and plentifully fed till weaned from this inclination.

The chickens require to be kept warm and dry, for the first few days after hatching, and they may be fed with hard-boiled eggs, crumbs of bread or pudding, and milk or water, and allowed to scratch in the gravel in front of the hen, which should be confined in a coop for the first three or four weeks, after which, they may be turned loose, when they will thrive on any thing the older ones eat. Many use them for the table when they are but a few weeks old; but they are unfit for this purpose, till they have attained full maturity. The white-legs are preferred by some, from the whiteness and apparent delicacy of the meat; but the yellow-legged are the richest and most highly-flavored. The color of the feathers, does not seem to affect the quality of the flesh or their character for laying. If we consider the principle of the absorption and retention of heat, we should assume the white coat to be best, as it is coolest in summer when exposed to the sun, and warmest in winter. Yet some of the white breeds are delicate and do not bear rough usage or exposure.

VARIETIES.—These differ materially in their sizes, shapes and colors. The *Dorking* is esteemed one of the best, being large, well formed and hardy, good layers and nurses, and yielding an excellent carcass. They are both white and speckled, and generally have five toes. The *Poland* is both white and black, with a large tuft, generally of white fea-

thers on the head. They are of good size, and excellent layers, but are seldom inclined to set, which makes them peculiarly desirable for such as wish eggs only. The *Dominique* is a speckled fowl, of barely medium size, compact, hardy, good layers, and valuable for the table. The *Bucks' county* fowl, heretofore principally reared near Philadelphia, possess but moderate pretensions to notice, except in their immense size, a brace of them having been fattened to 19¼ lbs. when dressed. The *Bantam* is but little larger than a pigeon, and is usually of a pure white, but is sometimes speckled. It is generally feathered to the toes, but may be bred with clean legs. It is very domestic, and a pleasant little bird around the premises, and is not unprofitable. The *Game cock* is of medium weight, and yields good flesh, but is a poor layer, and an undesirable tenant for the farm yard. Besides these, there are many fanciful varieties, as the *Creeper*, with excessively short legs; the *Rumpless*, without a tail; the *Frizzled*, with irregular feathers turned towards the head; the *Silky* or *Merino* fowl, with brown or buff down, instead of feathers; the *Negro*, with its black crest, wattles, skin, legs and feathers; the *Java* and *Cochin China*, of great size; several varieties of the *Top-knot*, and others.

The diseases of hens are not numerous or complicated, and may be mostly avoided by proper treatment and food, which are indicated with sufficient minuteness in the foregoing observations.

Gapes or pip is generally owing to drinking unwholesome or dirty water. Remove the white blister on the tip of the tongue, and wash with sharp vinegar, diluted with warm water; or compel the bird to swallow a large lump of fresh butter, mixed with Scotch snuff. It has been removed by opening the mouth and forcing a pigeon feather, with a tuft of the feathers left on the end, the others being stripped off, down the wind-pipe, and gently turning it as withdrawn, to be repeated the following day if necessary. This detaches large numbers of a slender red worm, collected in the larynx of the throat, which impedes respiration and swallowing. A little spirits of turpentine mixed with the food is a preventive; as are also clean, white-washed premises, and good food. Feed for a few days with light food, soaked bran and cabbage or lettuce chopped fine. *Roup*, *Catarrh* or *swelled head*, is shown by feverish symptoms, swollen eye-lids, frequently terminating in blindness, rattling in the throat and temporary strangulation. These are accompanied by a highly

offensive watery discharge, from the mouth and nostrils, loss of appetite, and much thirst. They should be placed near the fire; their head bathed in warm Castile soap-suds, or milk and water. Stimulating food, as flour or barley-meal, mustard and grated ginger, mixed and forced down the throat, Boswell says, has been effectual in their speedy restoration. This, like many other diseases, is contagious, and when it appears, the bird should be at once separated from the flock. ***Flux*** is cured by the yolk of an egg boiled hard; and boiled barley soaked in wine. *Costiveness* is removed by giving bran and water with a little honey; or give a small dose of castor oil. *Vermin* are destroyed by giving them clean sand and ashes to roll in, adding a little quick lime if necessary. Entire *cleanliness* is necessary for the avoidance of this and other diseases. A perfectly *dry* range is also essential, nor should there be too many together, as this is a fruitful source of disease.

THE TURKEY

Was unknown to the civilized world till the discovery of this Continent. It was found here both in its wild and domesticated state; and still occupies the whole range of the Western Hemisphere, though the wild turkey disappears as the country becomes settled. The wild is larger than the domesticated bird, sometimes weighing over 30 lbs. dressed. The color of the male is generally a greenish brown, approaching to black, and of a rich, changeable, metallic lustre. The hen is marked somewhat like the cock, but with duller hues. Domestication through successive generations, dims the brilliancy of their plumage, and lessens their size and hardiness. It also produces a variety of colors, though they are mostly of a black, buff, pure white, or speckled. They give evidence of the comparative recency of their domestication, in the instinct which frequently impels the cock to brood and take care of the young. Nothing is more common than for the male bird to supply the place of the hen, when any accident befals her, and bring up a family of young chicks with an equally instinctive regard for their helplessness and safety. The flesh of this bird, both wild and tame, is exceedingly delicate and palatable; and though not possessing the high game flavor of some of the smaller wild fowl, and especially of the aquatic, as the canvass-back duck, &c., it exceeds them in its digestibility and healthfulness. The turkey is useful principally for its flesh, as it seldom lays over a nest-full of eggs in

one season, when they brood on these and bring up their young. If full-fed, and their first eggs are withdrawn from them, they frequently lay a second time.

BREEDING.—Those intended for breeders should be compact, vigorous and large, without being long-legged. They should be daily, yet lightly fed through the winter, on grain and roots, and some animal food is always acceptable and beneficial to them. They are small eaters, and without caution will soon get too fat. One vigorous male will suffice for a flock of 10 or 12 hens, and a single connexion is sufficient for each. They begin to lay on the approach of warm weather, laying once a day, or every other day, till they have completed their litter; which in the young or indifferently fed, may be 10 or 12, and in the older ones, sometimes reaches 20. The hen is sly in secreting her nest, but usually selects a dry, well-protected place. She is an inveterate sitter, and carefully hatches most of her eggs. The young may be allowed to remain for 24 hours without eating, then fed with hard-boiled eggs, made fine, or crumbs of wheat bread. Boiled milk, curds, butter-milk, &c. are food for them. As they get older, oat or barley-meal is suitable, but Indian-meal uncooked, is hurtful to them when quite young. They are very tender, and will bear neither cold or wet, and it is of course necessary to confine the old one for the first few weeks. When able to shift for themselves, they may wander over the fields at pleasure; and from their great fondness for insects, they will rid the meadows of innumerable grasshoppers, &c., which often do incalculable damage to the farmer. Early chickens are sufficiently grown to fatten the latter part of autumn or the beginning of winter, which is easily done on any of the grains or boiled roots. The grain is better for cooking. They require a higher roosting place than hens, and are impatient of too close confinement, preferring the ridge of a barn, or a lofty tree to the circumscribed limits of the ordinary poultry-house. When rightly managed and fed, turkies are subject to few maladies, and even these, careful attention will soon remove.

THE PEACOCK AND GUINEA HEN.

The peacock is undoubtedly the most showy of the feathered race. It is a native of the southern part of Asia, and is still found wild in the islands of Java and Ceylon, and some parts of the interior of Africa. They are an ornament to the farm premises, and are useful in destroying reptiles, insects and garbage; but they are quarrelsome in the poultry yard, and

destructive in the garden. Their flesh is coarse and dark, and they are worthless as layers. The brilliant silvery green and their ever-varying colors, gives place to an entire white, in one of the varieties.

The Guinea hen is a native of Africa and the southern part of Asia where it abounds in its wild state. Most of them are beautifully and uniformly speckled; but occasionally, they are white on the breast, like the Pintados of the W. I. Islands, and some are entirely white. They are unceasingly garrulous, and their excessively pugnacious character, renders them uncomfortable inmates with the other poultry. Their flesh, though high colored, is delicate and palatable, but like the peacock, they are indifferent layers. Both are natives of a warm climate, and the young are tender and rather difficult to rear. Neither of these birds are general favorites, and we omit further notice of them.

THE GOOSE.

There are many varieties of the goose. Main enumerates twenty-two, most of which are wild; and the tame are again variously sub-divided. The *common white* and *grey* are the most numerous and profitable. The *white Bremen* is much larger, often weighing over 20 lbs. nett. It is of a beautiful snowy plumage, is domestic and reared without difficulty, though not as prolific and hardy as the former. The *China goose* is smaller than the grey, and one of the most beautiful of the family, possessing much of the gracefulness and general appearance of the swan. It is prolific and tolerably hardy, but has not thus far, been a successful rival with the first. The *Guinea* or *African goose* is the largest of the species, and equals the size of the swan, often dressing over 25 lbs. It is a majestic and graceful bird, and very ornamental to water scenery. Several other varieties are domesticated in the United States.

Breeding.—Geese pair frequently at one year old, and rear their young; but with some kinds, especially of the wild, this is deferred till two and sometimes three. They require a warm, dry place for their nests, and when undisturbed, they will sit steadily; and if the eggs have not been previously chilled or addled, they will generally hatch them all, if kept on the nest. To insure this, it is sometimes necessary to withdraw the first hatched, to prevent the old ones wandering before all are out. They should be kept in a warm sheltered place till two or three weeks old if the weather be cold

or unsettled. The best food for the goslings, is barley or oat, or boiled Indian-meal and bread. Milk is also good for them. They require green food, and are fond of lettuce, young clover, and fresh tender grass, and after a few weeks, if they have a free range on this, they will forage for themselves. Geese are not a profitable bird to raise, unless in places where they can procure their own subsistence, or at least during the greater part of the year. This they are enabled to do, whenever there are extensive commons of unpastured lands, or when there are streams or ponds, lakes or marshes with shoal sedgy banks. In these, they will live and fatten throughout the year, if unobstructed by ice.

They may be fattened on all kinds of grain and edible roots, but it is more economical to give them their food cooked. The well-fattened gosling affords one of the most savory dishes for the table. Geese live to a great age. They have been known to exceed 100 years. When allowed a free range on good food and clean water, they will seldom get diseased. When well fed, they yield nearly a pound of good feathers in a season, at three or four pluckings, and the largest varieties even exceed this.

DUCKS

Are more hardy and independent of attention than the goose, and they are generally the most profitable. They are omniverous, and greedily devour every thing which will afford them nourishment, though they seldom forage on the grasses like the goose, when they can procure other food. They are peculiarly carniverous, and devour all kinds of meat, putrid or fresh; and are especially fond of fish, and such insects, worms, &c., as they can find imbedded in the mud or elsewhere. They will often distend their crop with young frogs, almost to the ordinary size of their bodies. Their indiscriminate appetites often render them unfit for the table, unless fattened out of the reach of garbage and offensive matters. An English admiral used to resort to well-fattened rats for his fresh meat, when at sea, and justified his taste by saying, they were more cleanly feeders than ducks, which were general favorites.

The varieties of ducks are almost innumerable. Main describes 31, and some naturalists number over 100. The most profitable for domestic use, is undoubtedly the *common black duck*. They lay profusely in the spring, when well fed, often producing 40 or 50 eggs, and sometimes a greater

number, if kept from sitting. They are much larger than those of the hen, and equally rich and nourishing, but far less delicate. They are careless in their habits, and generally drop their eggs wherever they happen to be through the night, whether in the water, the road or farm-yard; and as might be expected from such prodigality of character, they are indifferent sitters and nurses. The ducklings are better reared, by setting the eggs under a sedate, experienced hen, as the longer time necessary for hatching, requires patience in the foster-mother to develop the young chick. They should be confined for a few days, and away from the water. At first they may be fed with bread, or pudding made from boiled oat, barley, or Indian-meal; and they soon acquire strength, and enterprise enough to shift for themselves, if afterwards supplied with pond or river water. They are fit for the table when fully grown, and well fattened on clean grain. This is more economically accomplished by feeding it cooked. The *light grey*, the *white duck*, and some of the *tufted*, are prolific, hardy and profitable. We omit further notice of other varieties, and of the swan, brant, pigeons, &c., as not profitable for general rearing, and only suited to ornamental grounds.

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B.

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